PRACTICAL PSYCHOLOGY

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Human Nature in Everyday Life

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TO MY COLLEAGUE

F. R. R.

PREFACE

The great majority of students who spend one quarter or one semester in a general course in psychology do no further work in this field. And many of them have no reason to go forward to expertness in such related fields of science as might revive the accomplishments of their brief experience in psychology. The short course in psychology can be made profitable only if the peculiar needs of such a course be squarely faced. Under these circumstances there should be a strong effort to integrate psychology with the issues of the work-a-day world. This does not require the teaching of the technical applications of psychology. It does, however, require the teaching of a *practical* psychology. Such a practical psychology is one in which scientific principles are given more emphasis than technical devices. But, more than this, it is a psychology in which these principles are selected and treated in such a way as to bring out their intimate relations to the personal and social life of the student. The present book is an attempt at such a psychology.

The educational background presupposed by this text is no greater than is likely to be possessed by a student in the latter part of the high school course. I believe that, with the use of such supplementary readings as are suggested at the end of each chapter, the book will also be fitted for college classes. It should be especially appropriate for students who are going almost immediately into the study of education, business, law, and other professional subjects. In trying to administer to such needs as these I hope that

I have done something which the general reader will find interesting.

In the writing of the book I have had much friendly assistance. From the inception of the project Florence Richardson Robinson has helped me on every type of problem that authorship involves. Professor Leon C. Marshall was one of those who first encouraged the plan of writing such a book as this. His criticisms of the manuscript have been invaluable. All, or nearly all, of the chapters have been read and commented upon by Professor Harvey Carr, Professor Leverett S. Lyon, Professor Francis M. Maxfield, Mr. Henry Reed Burch, and Mr. John A. Powell. Each from his own point of view has made many important suggestions.

Authors and publishers have been kind in permitting the use of illustrations and quotations. I have given specific credit for each of these favors at that place in the text where the material concerned is used.

E. S. R.

Chicago
July, 1926.

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PART I

A PREPARATION FOR PSYCHOLOGY

PRACTICAL PSYCHOLOGY

CHAPTER I

THE SCIENCE OF PSYCHOLOGY

A. The Subject Matter of Psychology
B. The Methods of Psychology
C. The Uses of Psychology

Questions to Keep in Mind while Reading this Chapter

1. What is psychology?
2. Why study psychology?

A. The Subject Matter of Psychology

Psychology is a study of human nature. — Psychology is a study of the ways of man — of how he sees and hears, of how he feels and thinks, of how he moves. In other words, this science is concerned with *human nature.*

At one time psychology had to do almost exclusively with the conscious experiences. But in late years it has been increasingly realized that what people do is quite as important as what they feel and what they think. And so psychology has come to have a great deal to say about action. Thus, human nature as it is looked upon by modern psychology embraces both mental life and behavior.

Everyone knows something about human nature. — Most people, when they begin the study of scientific psychology, are surprised at the number of facts and principles of mental

life and behavior which they have previously picked up without any effort to do so. Plainly, the reason for this is that human nature is always with them, either in themselves or in those about them. They see every day how practice increases skill and how skill is destroyed by anger and extreme fatigue. They know how people develop from helpless infants into adults competent to make their own ways in the world. Such matters pertain to human nature, and the fact that people generally are aware of them means that most individuals know some psychology, whether they have ever realized it or not.

But there are at least two important differences between scientific psychology and the psychology that one picks up incidentally. In the first place, the knowledge of human nature which is acquired without effort and serious study is very incomplete. Anyone can tell us that "practice makes perfect," but only one who has paid close attention to the question can begin to describe the many reasons why practice brings better results at one time than at another. In the second place, the psychology that is casually acquired contains many errors. There is a strong popular belief that a person can "feel it" if he is stared at, even when his back is turned. Careful students of human nature have submitted this belief to a test and they have found that it is quite false, that it has no basis in actual fact. We often come across the idea that those who are capable of doing well in one kind of study, such as mathematics, are, because of that fact, less likely to be capable in work differing widely from mathematics, such as history. Study of the problem has shown this belief also to be without foundation. A person possessing a good capacity for one type of intellectual work is more likely than not to possess a good capacity for other types of intellectual work. The science of psychology contains not

only more facts, but facts of greater accuracy than are to be found in popular opinions about human nature.

Most of psychology is based upon the normal adult. — The first thinkers who attempted to make a genuine study of human nature confined themselves almost exclusively to the normal adult. This was really quite natural. There is one person whom the student of psychology always has with him and whom he can observe more minutely and exhaustively than he can observe anyone else. This is himself. Furthermore, he is likely to understand best those who are most like himself — other adult human beings.

There are practical reasons why it is well that psychological interest has centered in the mental life and behavior of the mature human being. We need to have a clear idea of the normal adult in order to point the developing child in the right direction; we need to have a clear idea of normal, competent human nature in order to help those who are mentally sick back to a life of health and usefulness.

Nevertheless, psychology would be one-sided if the mental life and behavior of normal adults were its only basis. We must study children, the feebleminded and the insane, and even animals to gain a broad understanding of human nature.

Child nature is simpler than adult nature. — It is often extremely difficult to study the adult. The emotional life of the mature person is hard to get at because he has learned to hide his emotions to a large degree. No such control is present in the young child, and his emotional life is therefore more open to observation. The adult's action frequently comes after an elaborate process of deliberation which no one but himself can observe. The child's acts are likely to be more impulsive and the ideas and motives governing his behavior are often more evident. When he deliberates, this process is frequently carried out aloud.

In general, then, the nature of the child is so much simpler than that of the adult that it offers easier conditions for study.

There are, nevertheless, genuine difficulties to be encountered in the study of children. We are all prone to forget just how we felt and thought about things during our own childhood. This fact may bring about serious mistakes when we seek to interpret the mental life and behavior of the very young. Difficulties of this sort, though serious, are not insurmountable, and child study has in recent years become an increasingly important part of psychology.

Abnormal conditions exaggerate ordinary facts. — Human nature as it appears in the insane, the feebleminded, and the intoxicated has a special importance. In such cases there is usually an exaggeration of facts which are difficult to observe in normal individuals. The feebleminded person is one whose mental development has been held in check by some diseased condition. When such individuals learn to make even the simplest movements, the process is painfully slow. And yet this very slowness may give us an excellent opportunity to study the manner in which habits are formed. It is astonishing how much can be learned about running and batting from slow-motion pictures of those acts. In the feebleminded it is as though nature were presenting us with a slow picture of mental processes which, in the normal, go on so rapidly as to baffle our closest observation.

The insane or the intoxicated man who thinks that he is Napoleon is revealing in greatly exaggerated form a characteristic which is present in every normal person, but which under most circumstances is difficult to discover. While the normal individual does not actually believe that he is Napoleon or anyone else other than he is, he does have day dreams in which he sees himself in the seats of the mighty. But the

fact that he knows the difference between his dreams and reality makes him a little ashamed of his dreams and unwilling to let anyone else know about them. In the insane and the intoxicated, on the other hand, if the distinction between fancy and reality does not break down, it at least becomes unimportant. Thus, we have these individuals unhesitatingly displaying their fancies.

There is one primary precaution always to be observed in studying abnormal forms of human nature. We must not lose sight of the fact that what we are observing *is* abnormal and *is* exaggerated. The difference between believing one is Napoleon and wishing one were a great man is a difference of fundamental character.

Animal life offers favorable conditions for study. — Behavior and mental life in the child are simpler than in the adult. In the lower animals they are simpler still. For this reason the study of animals is a very profitable part of psychology. Another advantage in studying animals is that they can be used in experiments in which human subjects could not be used. In order to study the rôle of the brain scientists have removed various parts of this organ from rats and monkeys and then observed their behavior. Such experiments have the highest value, but no one would think of performing similar operations upon human beings unless disease or injury made it necessary for a patient's own good. Of course we must be cautious in reasoning from animals to men. We must not overlook the vast differences between animal nature and human nature simply because we are able to discover many points of similarity between them.

B. The Methods of Psychology

Psychology accepts many popular opinions about human nature. — As we have already said, everyone, as a result of

his ordinary experiences, learns some facts and forms some opinions about human nature. Many of these casually acquired facts and opinions are perfectly sound. In this case they can be taken over bodily into the science of psychology. Indeed, a great deal of psychology has been taken over in this way from popular thought and tradition. No scientist discovered that practice improves skill. This principle was discovered in everyday life long before the dawn of science. Thus, one of the most important methods by means of which psychology is enlarged is that of evaluating the knowledge of human nature which is constantly being acquired in the workaday world and including such parts of it as are valid in the subject matter of psychology.

The psychologist observes human nature in everyday life. — The knowledge of human nature possessed by most of us comes to a large degree from observing people as they go about their ordinary work and play. The psychologist also turns to daily life for many of his observations. But the psychologist does not observe people's everyday actions in quite the same fashion as does the layman. A distinguishing feature of scientific observation is that the scientist, at least in his own field of study, knows what he is looking for and to a certain extent what he is likely to find. If a boy, with little mechanical experience, is told simply to examine a certain automobile engine and learn all about it, he will make little headway. He will be lost in the complications of the machinery, because he does not know what is worth looking at and what is not. But a boy who has been given some wise instruction about gasoline engines, will make all sorts of interesting observations. The psychologist brings to his observations of ordinary behavior certain guiding principles. The fact that everyone can observe human nature does not make everyone a psychologist. A psy-

chologist must know what are the important features to look for in human nature. As we go on with this book we shall see what are some of these features.

The psychologist performs experiments. — The scientist is at a great advantage when he is able to carry out experiments. Events as they occur in ordinary life are almost always difficult to observe with exactness. Suppose that a person is suffering from nervousness. Upon questioning him, we learn that he drinks six cups of strong coffee every day. Now we know that this is a large amount and that it *may* be the cause of nervousness. There is a possibility, however, that there are more important causes for this case of nervousness than the excessive coffee-drinking. An ideal way of solving such a problem is by experimentation. We might have the sufferer continue to indulge in coffee drinking for a period during which we made careful observations of him. Then we might have him abstain from coffee for a considerable period. In this way it would be possible to compare the patient's condition in the presence of the effects of coffee drinking with his condition in the absence of these effects. The psychologist is able to use experiments in studying many problems of human nature. He has people learn poetry by various study methods and thus discovers what are the best ways of memorizing. He has people read under different conditions of illumination and thus discovers the best types of lighting.

The psychologist, in some of his experiments, simply sets his subject at a specified task under this, that, or the other set of circumstances and records the efficiency with which the task is accomplished. But there is another kind of procedure, known as the introspective experiment, which is quite different. In this case the subject plays a double part. He not only performs a set task, but he also observes his

own actions, thoughts, and feelings. In one experiment of this type the subject looks for a few seconds at a bright white light. Then the light is turned off and he is left in total darkness. But it does not seem like total darkness to him. He still seems to see the light, and as he continues to look, this *phantom* light keeps changing colors. Now in order to investigate an occurrence of this sort an introspective experiment is necessary, that is, an experiment in which reliance is put upon what the *subject* observes, rather than upon what is observed by the conductor of the experiment.

C. The Uses of Psychology

Knowledge of psychology is useful for everyday life. — We wish to get on well with others and to control our own thoughts and actions. For both of these purposes we require some understanding of human nature. If our knowledge be scientific and sound, so much the better.

Two men were carrying out a piece of work together. Things did not go as well as they might because one of the men kept talking about "my job" instead of "our job" and because he kept saying to his partner, "I want you to do thus and so," instead of, "Don't you think it would be wise to do thus and so?" If the man who spoke so undiplomatically had studied human nature thoroughly and had formed the habit of looking for the causes of human behavior, he would not have been so surprised when his companion became sullen and unco-operative. And if his companion had become used to looking at himself scientifically, he would have realized that he was suffering quite as much from his own hurt pride as from any important grievance. A knowledge of psychology does not always make one a diplomat, nor is it a sure cure for false pride. But through the study of this subject one should cultivate habits of thoughtfulness

about human nature which will prove helpful in understanding just such situations as the one described.

The habit of remembering that there is a scientific way of solving many of the problems of human nature will keep us on the lookout for better methods of emotional control, for better methods of study, and will in general prevent our treating human nature, either in ourselves or in others, in a shortsighted and prejudiced manner.

Psychology is basic for education. — When the new-born babe enters upon the adventures of life he can scarcely be said to have a *human* nature. He knows nothing about the world and he has no control over his own actions. Yet he has powers of acquiring knowledge and self-control. It is the purpose of education to aid the child in realizing his possibilities of development. An enterprise so vitally concerned with human nature should, of course, keep in close touch with psychology.

It is no accident that psychologists have made important contributions to the practice of teaching. Psychologists have studied how learning goes on, what factors make for efficient learning, how forgetting takes place. And no one seriously interested in the best methods of education would ignore what has been discovered about learning and forgetting.

Psychology is important for medicine. — Modern medical practice is based upon a number of sciences — upon anatomy which deals with the structure of the body, upon physiology which deals with the action of the various organs, upon pathology which deals with disease, and upon a long list of others. Among the sciences which should form the background of sound medical practice is psychology. Although many a physician has succeeded with no psychology except that of common sense, many another has failed because of

a lack of understanding of human nature. The medical man is frequently confronted with questions which have little to do with disease in the usual sense of the word, but which do involve human nature. There is often a greater need for removing a patient's anxiety than there is for changing his diet or giving him medicines.

In recent years there has been a general recognition of the fact that there are forms of sickness which are really nothing but very bad habits. Not long ago a man went to his doctor because he was seized by a terrible dread whenever he went into a crowd. The chances are that no amount of knowledge of the patient's bodily condition would have revealed the source of his difficulty. Somehow and somewhere he had acquired a bad emotional habit — perhaps years before as a little child he had been lost in a crowd. If so, the only hope lay, not in administering drugs, but in retraining.

Psychology is useful for the practice of law. — In connection with education and medicine we have stated only a few examples of how a knowledge of psychology may lead to sounder practice. Likewise in the case of law, we shall simply give an instance or two of the possible uses of psychology. One of the most important of legal questions has to do with the degree to which any particular criminal is responsible for his actions. If one man attacks another, the court wants to know, not only whether the accused individual actually did make the attack, but, in case he did make it, why he acted as he did. Thus, we see a need for knowledge of why people do the things they do, of what forces are capable of affecting human behavior. Another set of psychological problems of great legal importance has to do with the accuracy of testimony. Many of the facts upon which court decisions are based are furnished from

memory by witnesses. Psychologists, as we shall later see, have studied in detail the accuracy of memory and have discovered many of the types of error which are to be expected in ordinary testimony.

Business has its psychological problems.—In the early development of business and industry there was such a strong emphasis upon the improvement of machines and materials that human nature was largely neglected. In late years, however, there has been a pronounced interest in the human problems of business. This has meant a turning of the business man's attention to psychology.

Some of the first applications of psychology to business were in the fields of advertising and selling. It is evident that both of these branches of business will be successful only to the degree to which they are based upon a sound appreciation of the desires and motives that lie behind the making of purchases.

A second group of human problems in business has to do with the selection of workers. The psychologist's contribution in this field has been mainly in the form of tests for measuring ability. Some of these tests have been designed to deal with the special abilities required in certain occupations, while others have dealt with such general traits as "brightness" or "intelligence."

There is a still more vital need for sound knowledge of human nature in connection with the treatment of workers after they have been employed. No matter how carefully men are selected, there are, nevertheless, questions regarding the handling of those men. If they are to give their best, there must be incentives adequate to arouse ambition. If they are to attain high levels of expertness, they must be trained in the best possible manner. In both cases the employer is confronted with psychological problems.

Summary of the Chapter

1. Psychology deals with human behavior and mental life.

2. Scientific psychology is to be distinguished from popular psychology because of the greater number and accuracy of the facts about human nature which it contains.

3. Psychological knowledge has been gained mainly from the study of the normal human adult. This is due partly to the fact that psychologists have found it convenient to make many of their observations upon themselves.

4. The psychologist has also drawn facts and principles from studies of children, of individuals in abnormal conditions, and of animals.

5. Many of the principles of scientific psychology first come to light in popular thought. Consequently the psychologist is constantly examining popular notions about human nature and adopting such of them as are valid.

6. The psychologist studies human nature as it appears in everyday life, but his observations are not haphazard. He is usually able to tell the difference between important and unimportant facts.

7. Whenever possible, the psychologist makes his observations by means of experiments. In some of these he simply records the performances of subjects tested under varying conditions. In others, the introspective experiments, the subjects, themselves, observe and report what goes on.

8. Psychology has many uses. It can be applied to everyday affairs of self-control and of controlling others. It should be the basis for education. It should enable the physician to understand his patients and to cure them of such troubles as are really only bad habits. In law and business there are numerous problems of a psychological nature.

PROBLEMS

1. Psychology deals with how man sees, hears, feels, thinks, moves. With what other matters would you expect a science of human nature to deal?

2. State five truths about human nature with which people are familiar, whether they have made a study of psychology or not.

3. Why is it well that psychology is not based entirely upon self-observation?

4. What do you suppose is the chief difficulty in the way of studying the mental life of animals?

5. Do you accept the common belief that red-headed persons usually have hot tempers, or would you like to see this belief subjected to a scientific test? Why?

6. Describe an experiment dealing with human nature which you would like to perform. Why would you expect to learn more from it than from casual observation? (Do not quote the experiment mentioned in the text.)

7. What uses besides those we have cited can you see for a scientific knowledge of human nature?

REFERENCES FOR FURTHER STUDY

The supplementary readings which follow this and later chapters are selected especially for classes which lack ready access to an extensive psychological library. Although the readings are from many works and authors, they may all be found in a single book — *Readings in General Psychology*, edited by Robinson and Robinson and published by the University of Chicago Press. References to these readings will give both the regular place of appearance and the place of appearance in the above-mentioned collection. The instructor who is able to send his students to a well stocked psychological library will undoubtedly wish to add in his own way to the present list of supplementary readings and perhaps in some instances to substitute selections which he thinks are more appropriate and important.

The collateral readings suggested in this book contain more matter than is likely to be covered by most classes in a one-semester course. This fact will give the teacher an opportunity to use any amount and selection of collateral material appropriate to the general maturity of the students making up his class.

Pearson, *The Grammar of Science* (3d ed.), Part 1, pp. 12–14; or *Readings in General Psychology*, Ch. 1, Selection 1-A, p. 1 ff.

Titchener, *Popular Science Monthly*, 1914, pp. 42–43; or *Readings*, Ch. 1, Selection 1-B, p. 3 ff.

Thorndike, *The Principles of Teaching*, pp. 265–266; or *Readings*, Ch. 1, Selection 1-C, p. 5 f.

Clifford, *Lectures and Essays* (3d ed. Eversley Series), Vol. II, pp. 50–51; or *Readings*, Ch. I, Selection 2-A, p. 6.

Ebbinghaus, *Psychology* (trans. and ed. by Max Meyer), pp. 3–9; or *Readings*, Ch. I, Selection 2-B, p. 7 f.

Dunlap, *A System of Psychology*, pp. 1–4; or *Readings*, Ch. I, Selection 3-A, p. 9 f.

Angell, *Chapters from Modern Psychology*, pp. 76–79; or *Readings*, Ch. I, Selection 5-A, p. 20 f.

Galton, *Inquiries into Human Faculty and its Development* (Everyman's Library), pp. 45–46; or *Readings*, Ch. I, Selection 5-B, p. 22.

Yerkes, *Introduction to Psychology*, pp. 52–55; or *Readings*, Ch. I, Selection 7-A, p. 26 ff.

Thorndike, *Journal of Educational Psychology*, 1910, pp. 6–7; or *Readings*, Ch. I, Selection 7-B, p. 28 ff.

CHAPTER II

HUMAN NATURE AND THE HUMAN BODY

A. How the Nervous System, the Sense-Organs, the Muscles, and the Glands Work together

B. Special Organs Involved in Behavior and Mental Life

Question to Keep in Mind while Reading this Chapter

What organs of the body play the most important part in human behavior and in mental life?

The most distinguishing features of human nature are man's behavior and his mental life. Human digestion, circulation, and breathing are carried on in much the same fashion as in many of the animals, but human behavior and human mental life are scarcely approximated even in the highest apes. The bodily organs most directly responsible for mental life and behavior are contained in the nervous system, which includes the brain. Closely related to the nervous system are the sense-organs, the muscles, and the glands.

In the present chapter we shall discuss in a brief way those parts of the body which are so important for *human* activities. First we shall consider how the sense-organs, the nervous system, the muscles, and the glands all work together. Then we shall consider these organs separately and in greater detail.

A. How the Nervous System, the Sense-Organs, the Muscles, and the Glands Work Together

All knowledge depends upon sense-organs. — There are within the human body and on its surface certain organs called sense-organs, or *receptors*, which receive stimulation. Without the action of these organs, we could be aware of nothing. Through the receptors of the skin we are aware of temperature changes and of objects and forces in contact with the outside surface of the body. Through receptors in the head — the eyes, the ears, and the nose — we are aware of neighboring objects, even if they are not actually in contact with us. Through receptors within the body we are aware of our bodily activities. In fact, so dependent are we upon the proper working of these organs of sense that we cannot even imagine anything independently of the manner in which it affects our senses. Everything in this world of ours is a something touched, seen, heard, tasted, or in some other way experienced by means of sense.

Action depends upon muscles and glands. — But the mere experiencing of what goes on within us and about us would be of little value if we could not do something about it. If we could not act in the presence of pain or of food, why should we be aware of them? While the receptors are indispensable aids in gaining impressions of the world, something more is needed if anything is finally to result from those impressions.

And again we find certain other bodily organs playing a vital part in mental life. These we call *effectors*, which is very natural considering the fact that they bring about the *effects* or results of the impressions which the world makes upon us. There are two main classes of effectors, (1) the muscles, and (2) the glands. The muscles bring about

movements of the whole body or of its parts. The glands secrete substances like saliva or digestive juices which put the body in better working order and thus aid its activities.

The nervous system connects receptors and effectors. — It is evident that we could have no mental life without sense-organs, and that nothing could ever come of our mental life without muscles and glands. A little thought also shows us that there must be some connection between the muscles and glands and the receptors, for otherwise the action of the muscles and glands would not be in accord with what was acting on the receptors. As a matter of fact, there is a very complicated set of organs called the nervous system which does connect sense

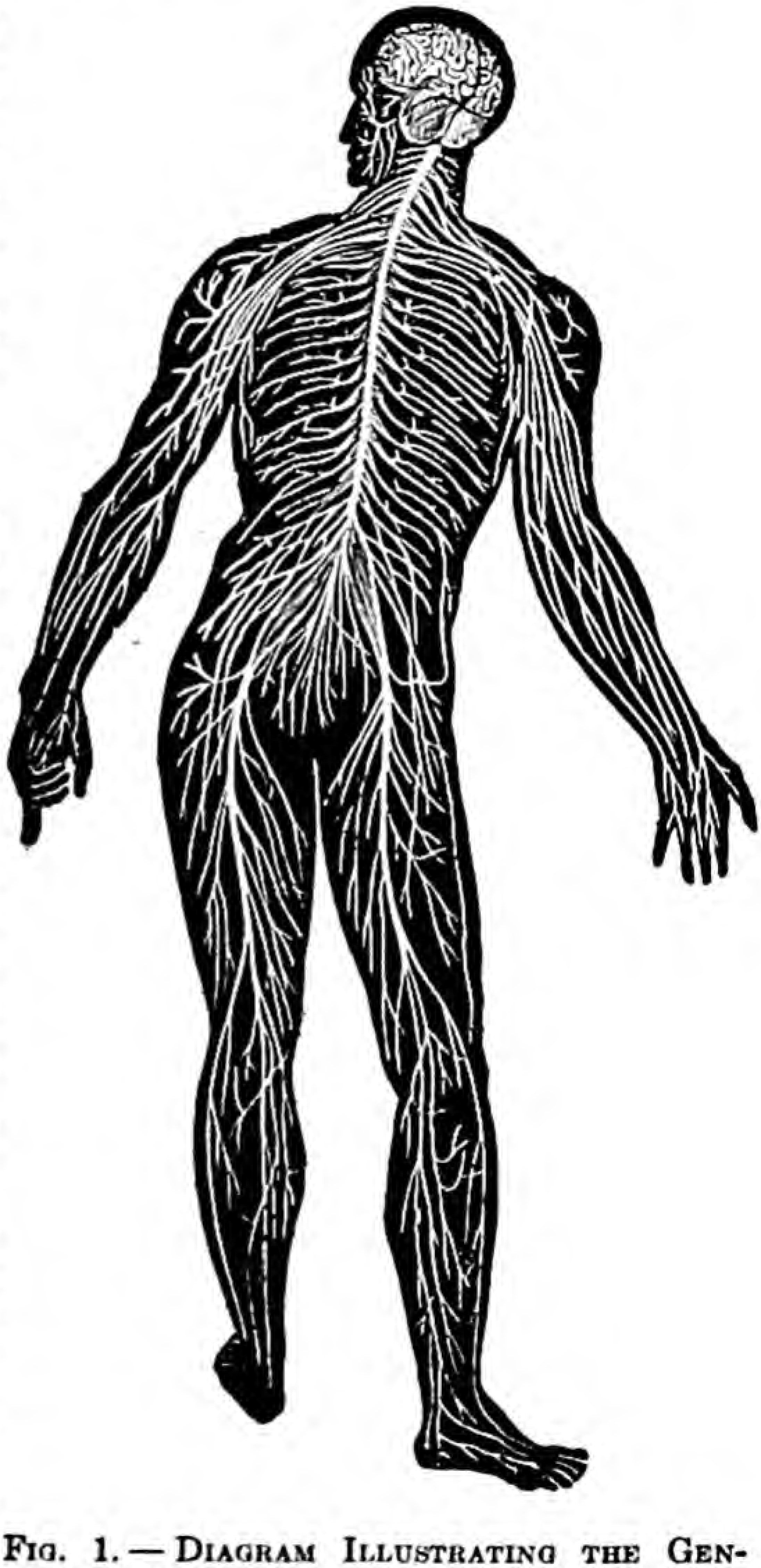


FIG. 1. — DIAGRAM ILLUSTRATING THE GENERAL ARRANGEMENT OF THE NERVOUS SYSTEM

with action. Nerves lead from receptors in all parts of the body to the spinal cord, which lies within the spinal column, and to the brain, which lies within the skull. These organs, the spinal cord and the brain, are themselves masses of interconnected nerves, and from them nerves run out to all the muscles and glands. Whenever a sense-organ is stimulated, an impulse is set up which passes along the nerves to the cord or brain and then out again to some muscle or gland, or to a number of muscles or glands, which immediately become active.

FIG. 2. — A LENGTHWISE SECTION THROUGH THE SKULL AND SPINE

This drawing shows the brain, the spinal cord, and the spinal nerve roots.

The nervous system, as a collection of links between all parts of the body, is the primary basis for the co-operative working of the different parts of the body. It is the main bodily basis of our ways of acting, feeling, and thinking.

How we know the importance of the nervous system. — There are many reasons why we are so sure of the indispensable rôle played by the nervous system in behavior and mental life. In the first place, it is the principal connection between the senses and the muscles, and without it neither of these would be useful. Secondly, we know that a knock on the head, certain drugs, a high fever, and other conditions which profoundly affect the nervous system disturb our mental life. It is not the sense-organs or muscles of the sleeping man, the man under chloroform, or the man in a delirium that are

mainly affected. It is the nervous system that connects these sense-organs and muscles. Thirdly, we know that the main difference between highly intelligent man and the less intelligent animals lies, not so much in sense-organs, muscles, or glands, as in the nervous system. If we examine different animals, including man, we find that, in those whose mental life is simple, the nervous system is comparatively simple. In those whose mental life is complex, the nervous system, especially the brain, is also complex.

Mental life affected by all bodily processes. — It would be a mistake to suppose that our mental life is not connected with bodily processes other than those of the sense-organs, the nervous system, the muscles, and the glands. If the circulation of the blood stops, mental life stops. If breathing is interfered with, there results a mental disturbance. If digestion is not going on efficiently, our disposition is likely to be affected. But it is only in so far as these disturbances affect sense-organs, nervous system, muscles, or glands that our mental life is affected by them.

B. Special Organs Involved in Behavior and Mental Life

Receptors provide for contact with surrounding world. — The receptors, or sense-organs, are always points of contact between the individual and the events taking place within him and around him. Each receptor is not, however, sensitive to all kinds of happenings. Rays of light arouse the eye — the organ of vision — to action, but such rays do not affect the organ of hearing in the ear, and would not do so even if they could penetrate to that point deep in the head where this organ is located. Sound, on the other hand, affects the ear, but not the eye.

Those objects and occurrences that affect our senses are

called *stimuli*. Thus, a mechanical impact against the skin is a stimulus for the sense of touch; a severe impact of the same kind is a stimulus for pain; and changes of temperature arouse sensations of warmth and cold. Light is the stimulus for vision, and sound the stimulus for hearing. Certain substances in solution are, when present on the tongue, stimuli for taste, and certain gases which get into the nose are stimuli for the sense of smell. Besides the stimuli produced in the surroundings of the individual, there are others which are produced by his own bodily activities. The movements of muscles arouse sensations of a certain kind, and such internal affairs as the too rapid beating of the heart during strong emotion, the contractions of the stomach during hunger, and the dryness of the throat in thirst, produce their own special sensations.

Man has increased the power of his senses. — And, yet, with all of this, we are in contact directly through our senses with only a very small fraction of the forces of the world within which we live. There are many experiences we might have, but do not have because our senses are not delicate enough. Man has made up for these deficiencies of sense in many ways. The telescope has extended his sight until he can see other worlds as if at a comparatively close range. Drawing, painting, and photography have made it possible for him to see again events that are past and might otherwise be forgotten. The motion picture is one of the most recent improvements in the sense of sight. The telegraph, the telephone, and the radio have enabled man to hear sounds originating at great distances. The phonograph has made it possible to hear repeated production of sounds which otherwise would have perished. All sorts of vibrations which our unaided sense-organs are not acute enough to detect are detected by means of instruments which man has

invented. There are instruments now in use that detect earthquakes in the remotest corners of the earth.

Sometimes it is advantageous to decrease rather than to increase the powers of our senses. Modern surgery with its great achievements in the saving of human lives is possible only because in chloroform, ether, and other anaesthetics we possess the means of temporarily suspending the action of the sense of pain.

Sense-organs vary in structure. — The structure of the receptors varies widely. Pain is aroused by the action of so-called free nerve ends, the ends of nerves which have no particular receiving organs attached to them. But most of the sense-organs are special structures which are set in action by some special agent, such as light or sound or contact, and which in turn set up impulses in the nerves attached to them. Perhaps the most elaborate of the receptors is the eye. In the eye are cells especially designed to convert the energy of light into the energy of the nerve current. Besides this, there is a system of lenses and focussing apparatus to regulate the reception of light from points at different distances, and of light of different degrees of brightness. We shall have more to say about the structure of the sense-organs in Chapter VIII.

Some receptors affected by external happenings. — As we have previously pointed out, certain senses are set in action by what goes on at the surface of our bodies. This is true of touch, cold, warmth, and pain. There are other senses through which we are aware of happenings at some distance from us. We do not see the light itself, but rather the object from which the light is reflected or transmitted, such as a wall or a lamp. The sound likewise is judged to be the sound which something at a distance is making. It is the drum and the cannon we are usually interested in rather

than the sound itself. The same is true of the odor of food or of flowers. Receptors which thus make us aware of happenings at the surfaces of our bodies or at a distance are *exteroceptors.*

Some receptors affected by bodily movements and postures. — We have also mentioned the fact that certain receptors record our movements. Within the tissues of the muscles and at the joints of the limbs there are sense-organs aroused by movements and postures. In the ears there are small structures called the *semicircular canals* which are involved in movement and in the balancing of the body. These organs of the muscles, joints, and ears are called *proprioceptors.*

Some receptors affected by internal conditions. — Certain receptors record the progress of events within our bodies. Those of taste are the best defined of these. Hunger, thirst, nausea, and internal pains depend upon these sense-organs within the body. The name for them is *interoceptors.*

The result of sense stimulation is action in muscles or glands. — The final result of the stimulation of a sense-organ is action in some muscle or gland. Most muscles act only when a nerve impulse sets them in action. The action of glands is sometimes aroused by nerve impulses and sometimes by substances (hormones) which the blood conveys to them from other glands. But the important fact for us in our present study is that sense stimulation sets up nerve impulses which travel in to the spinal cord and brain, and then out again to the effectors.

Of the two chief classes of effectors — muscles and glands — the former are much better understood and of much greater importance for an understanding of human nature. The muscles have been classified in a number of different ways. But the most significant distinction, from the point

of view of psychology, is between the *voluntary* and the *non-voluntary* muscles. The important voluntary muscles are those which move the body parts about their joints. The muscles of arms, legs, neck, and jaw are of this class. While movements of these parts sometimes become quite automatic, they are typically under voluntary control. The principal non-voluntary muscles are those which have to do with such internal matters as digestion and circulation. One may become aware of the action of such muscles. One may even become able to control them to a limited degree. But typically, the operation of these non-voluntary muscles goes on automatically.

Courtesy of Ginn and Company

FIG. 3. — EFFECTORS, MUSCLES RAISING THE FOREARM FROM THE ELBOW

The dotted lines within the muscle show the distribution of the nerve fibers. (From Judd, *Psychology*.)

There are two main groups of glands. The *duct glands* secrete substances on to the surface of the body or into the body cavity. The sweat glands secrete on to the surface of the body, and so do the tear glands. Glands in the walls of the mouth, stomach, and intestines secrete into those organs saliva and other fluids which aid in digestion. The *ductless glands*, often called the *endocrine* organs, secrete substances into the blood. The action of glands is much like that of the non-voluntary muscles in that it is almost always quite automatic. The study of these organs is more important for a detailed knowledge of the working of the body than

it is for our present goal, which is a knowledge of mental life and behavior.

Man has increased the power of his effectors. — The effectors (and we are now speaking principally of the muscles) with which man is equipped enable him to act in many ways. But just as the sense-organs have their limitations, so have the muscles. Man can move his body from place to place, but not at a very fast rate. He can lift objects and bend them and tear them and put them together again in new ways, but there are definite limits to his strength. And so he has proceeded to create machines which add to his powers. Ships, trains, automobiles, and airplanes have extended his powers of locomotion. Tools and machines of various kinds have enabled him to perform feats with the materials about him which he could not perform with his unaided muscles. Think of the great stones hoisted by derricks, and the stiff and hard metals fashioned into new shapes by machines of various kinds!

Route of nerve impulse from receptor to effector known as the neural arc. — When a receptor is stimulated, whether it be the eye, ear, tongue, or skin, an impulse runs along the nerves to the spinal cord or brain, and then out again to an effector. This route which the impulse follows is called the *neural arc.* At one time psychologists did not pay so much attention to the fact that the impulse going in to the spinal cord and brain comes out again to the effectors. They were interested mainly in the fact that the world acts upon the individual and makes impressions upon him or arouses experiences in him. But now we know that this outflowing of the impulse to the effectors is the one most important fact about the nervous system. Of what service would it be to man to see the obstacle in front of him if his muscles could not take him around it? Of what service would it be for

him to smell food if his muscles would not carry him to that food? True, we do not make an important move in response to everything that affects our senses, but none of those things of which we are aware would be of any interest to us — it is doubtful whether we should ever learn to recognize them — were it not for the fact that sometimes, at least, their presence sets us in action. *In other words, the nervous system's real duty is to connect receptors and effectors so that experience can lead to action.*

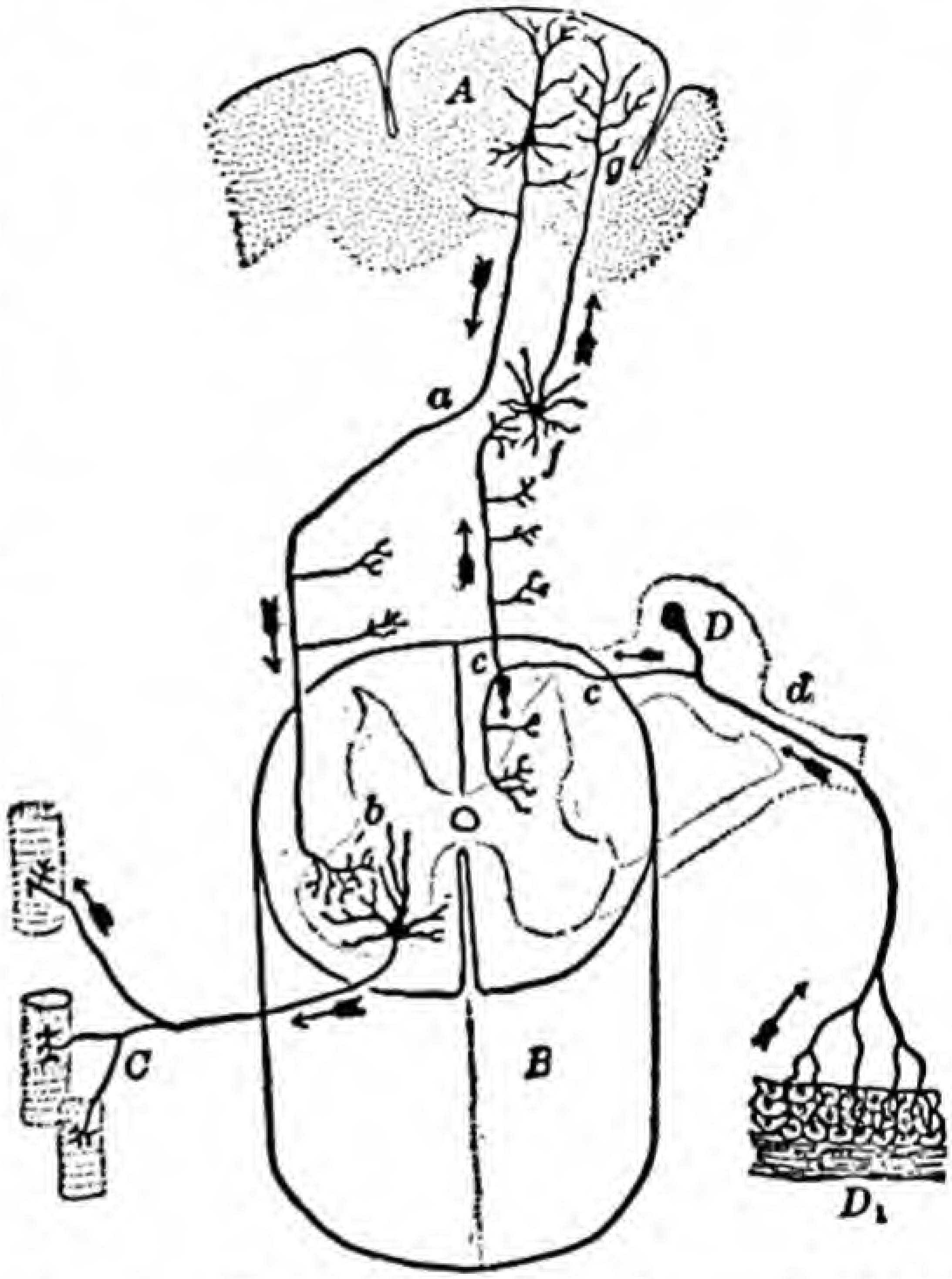


FIG. 4. — THE COURSE OF A NERVE IMPULSE

This drawing shows the connections between neurons, and the course that a nerve impulse might take if the skin at *D* were stimulated in such a way as to cause contraction of the muscle fibers at *C* on the other side. *A* represents the outside of the brain and *B* represents the spinal cord. (After Cajal.)

The actual route of a nerve impulse from receptor to effector is very complicated. But Figure 4 shows in principle what takes place when a finger is withdrawn from the prick of a pin. The stimulation occurs at D_1 where the nerve ends in the skin. An impulse is set up which traverses a neuron, or nerve cell, as indicated by arrows, to the interior of the spinal cord. Within the spinal cord the impulse passes up through neurons *e* and *g*, to the surface of the brain *A*,

where it is transferred to a descending neuron *a*, by means of which it passes to a lower level of the spinal cord *b*. There it is again transferred to another neuron, by means of which it passes to the muscles *C*.

Nervous system composed of two sub-systems. — The nervous system as a whole is composed of two sub-systems: (1) the *cerebro-spinal*, and (2) the *autonomic*. The cerebro-spinal system comprises the brain, the spinal cord, and the nerves which lead in to them from the sense-organs and out of them to the muscles. The autonomic system comprises a chain of nerves running along each side of the vertebral column or backbone, and certain other nerves scattered throughout the head and body. The cerebro-spinal system is responsible for most of our voluntary acts. The autonomic system is not independent of the cerebro-spinal system. In fact, the two are very closely connected, but the autonomic system is especially important for those muscular and glandular activities within the body which are carried on without our being conscious of them, or at least without conscious control or direction. In emotion, where there is rapid heart beat and other pronounced activities of the internal organs, the autonomic system plays an important part. But the vast majority of peculiarly human actions are more immediately related to the cerebro-spinal system. For that reason, we shall say nothing more about the structure of the autonomic system, and a good deal more about the cerebro-spinal system.

Cerebro-spinal system has central and peripheral parts. — The cerebro-spinal system has a *central* portion and a *peripheral*, or outlying portion. The central portion is made up of spinal cord and brain. The peripheral portion is made up of twelve pairs of nerves called the *cranial nerves*, which connect with the brain directly, and thirty-one pairs of nerves

called the *spinal nerves*, which connect with the spinal cord. (See Figure 1.)

Cerebro-spinal system is symmetrical. — Perhaps the most striking feature of the complete cerebro-spinal system is its symmetry, that is, its division into corresponding right and left halves. A deep fissure divides the brain into right and left halves, and a similar, though somewhat less marked division, is present in the spinal cord. The peripheral nerves, as we have seen, exist in pairs, one member of each pair joining the central nervous system at the right and the other at the left.

What the peripheral nerves do. — In the peripheral nerves are two kinds of nerve fibers: (1) those that convey impulses *in* from the receptors to the central nervous system, and (2) those that convey impulses *out* from the central nervous system to the muscles. The first are called *afferent* fibers, and the second are called *efferent* fibers.

Impulses from sense-organs in the face and head are carried in by the afferent cranial fibers, and impulses going out to muscles in the face and head pass over the efferent cranial fibers. Most impulses from sense-organs in parts of the body lower than the head and face go along the afferent spinal fibers, and those going out to muscles below the head go along the efferent spinal fibers. Those impulses passing to or from the arm go over the upper spinal nerves, and those passing to or from the leg go over the lower spinal nerves.

What the central nervous system does. — The central nervous system (the spinal cord and brain) is composed of great masses of nerve fibers. Some of these convey impulses up and down the cord. Others convey impulses from one side of the cord or brain to the other. (It is of course very necessary that the two halves of the body should be connected.) Still other fibers make connections within a

single half of the central nervous system and at the same level.

A little further back we said that the spinal cord and brain serve to connect the sense-organs and the muscles. If it were only necessary for one sense-organ to be connected with one muscle, this would be a simple matter. But in a well-organized individual, it is necessary that means of connection exist between each sense-organ and a great many muscles. When the starter shouts, "Get ready!" almost every muscle in the runner's body becomes tense. This means that nerve impulses starting from his ears spread out into a large number of muscles. In order for this to happen, impulses must be able to pass up and down and across the brain and cord.

The central nervous system is often likened to a great telephone exchange where the incoming message may be sent out along any one or many lines. This system has no operator who makes these connections. The connections are formed by training. The words "Get ready" would not arouse the same tightening of muscles in a foreigner who had had no training in English or in the customs of racing. But in one who has had the proper training, the connections are made automatically. Indeed, in such a person the connections are relatively permanent connections, or, as we usually call them, *habits*.

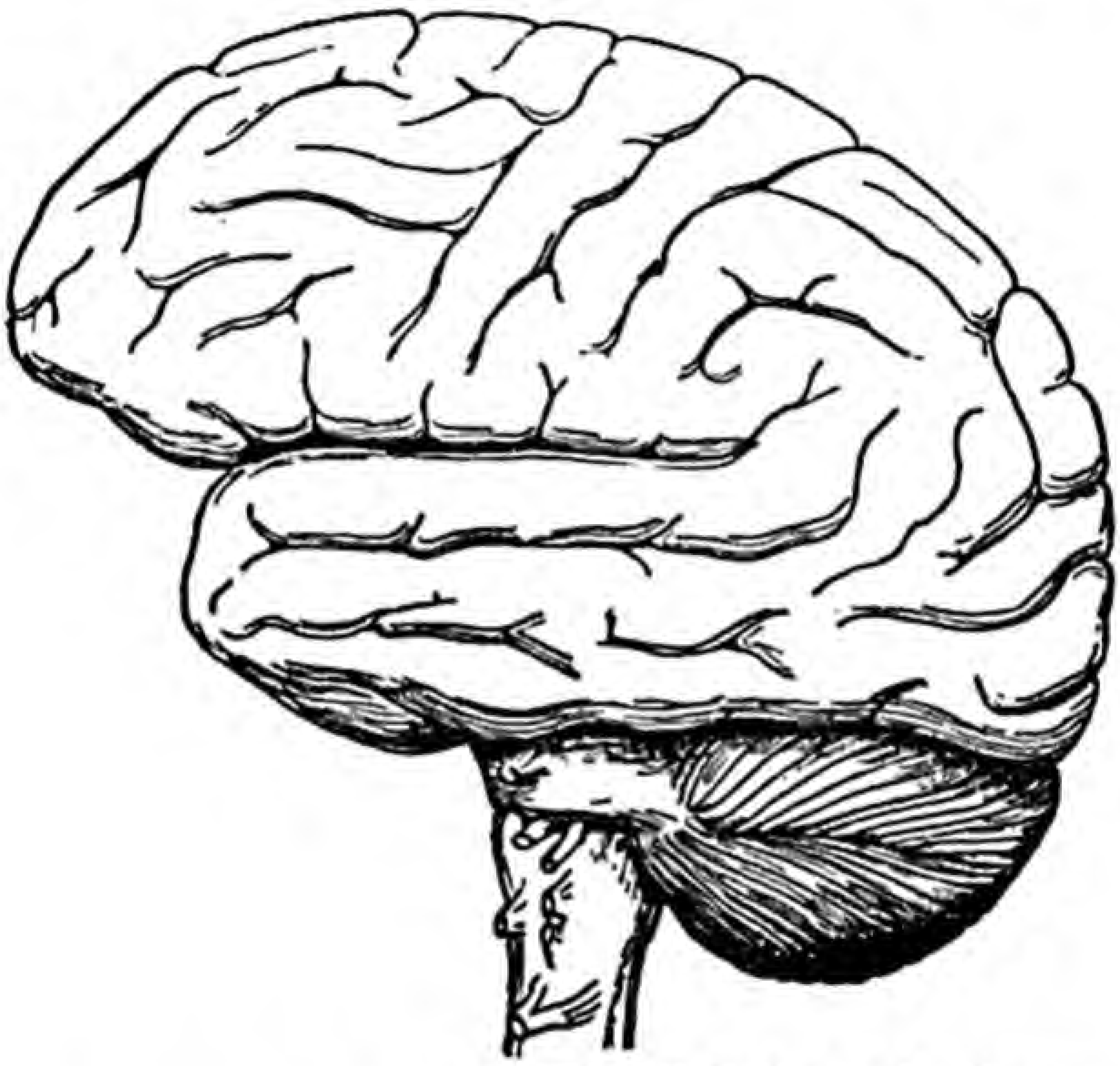
What happens in the brain. — There are in the body a great many sense-organs, and usually they are all active at once. During the day, there is a continuous stream of impulses set up by what we are seeing, hearing, and smelling. By contact, our clothing is constantly stimulating the sense organs of touch. Slight changes in temperature are constantly stimulating our sense-organs for cold and warmth. Throughout the day impulses are set up in our internal

organs; sensations of hunger, of thirst, of fullness are persistently with us.

With such a volley of impulses constantly coming in to the central nervous system, it seems remarkable that our actions are not chaotic, that they do not forever interfere with each other. Evidently the individual impulses in this multitude of impulses must work together in some way. Now this is just what does happen. The different impulses present at any one time act upon each other, and if that interaction is efficient, an orderly type of movement results. Usually one group of impulses will dominate over the others. Consider the quarterback waiting to catch a punt coming toward him. The roar of voices in the stands, the cool breeze on his cheek, the thought of possible consequences if he fumbles the ball, all compete with the impulses whose natural expression is in a good catch of the ball. If our player is well trained, the impulses which would result in the catch are dominant. We say he is well trained and well *co-ordinated* because of the fact that the result of a multitude of impulses is efficient action — catching the ball.

Such efficient action is possible only because there exists at one end of the central nervous system a larger mass of nerve fibers called the *brain*. The brain is a very complicated structure. It will suffice for us at the present time to note that it has two principal parts: (1) the *cerebrum* above and forward, and (2) the *cerebellum* below and behind. Practically every impulse entering the central nervous system reaches the brain. It is there that impulses from different sense-organs get into a place where they can influence each other. It is there that these impulses work together in such a way as to produce efficient and not chaotic action of the muscles.

If we again think of the central nervous system as a great telephone exchange, the brain may be conceived as the very heart of the exchange, as the one room where it is possible to connect any individual telephone with any other individual telephone, as the one place where it is possible to know at any given time what lines are in use and what are free.



Courtesy of W. B. Saunders Company

FIG. 5. — THE HUMAN BRAIN FROM THE LEFT

The cerebral hemisphere is the main mass above and at the left. The cerebellum, with its narrow convolutions, is below and behind. The medulla bears the stumps of several cranial nerves. (From Stiles, *The Nervous System and Its Conservation.*)

The brain dominates the human body. — Since the brain is the organ by means of which actions and thoughts are made more orderly and more closely related to each other, it is plain that the brain is necessary for intelligent beings. If we examine different members of the animal kingdom, we find that those that are most intelligent are most dominated by brain action. An earthworm has a brain of a sort,

but a great part of its actions apparently have little effect upon and are little affected by the brain. A dog whose brain and spinal cord are severed in such a way that most of his body is out of connection with his brain still gets along fairly well. He eats and performs other simple acts with almost normal efficiency. But in man, life is dominated by

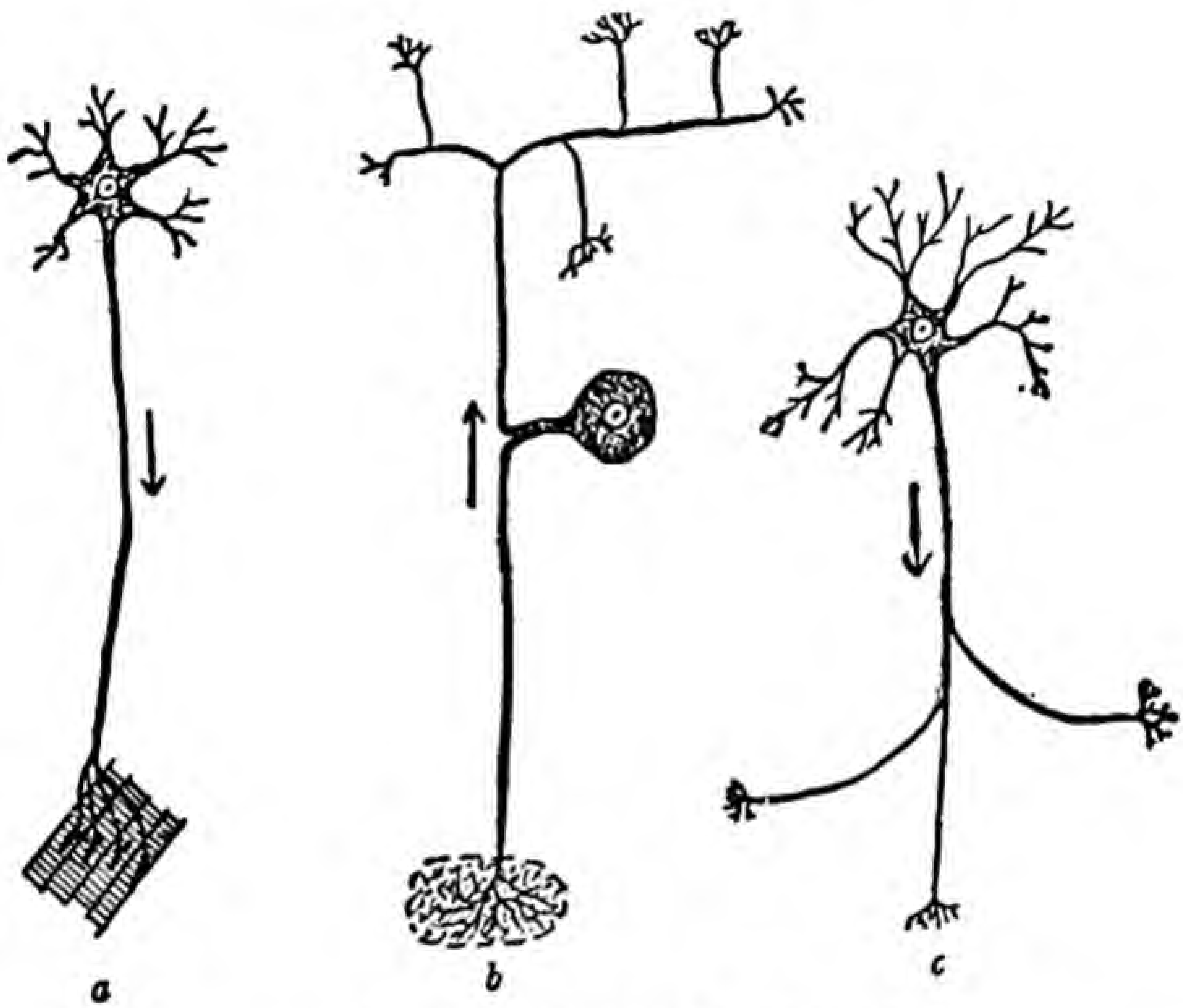


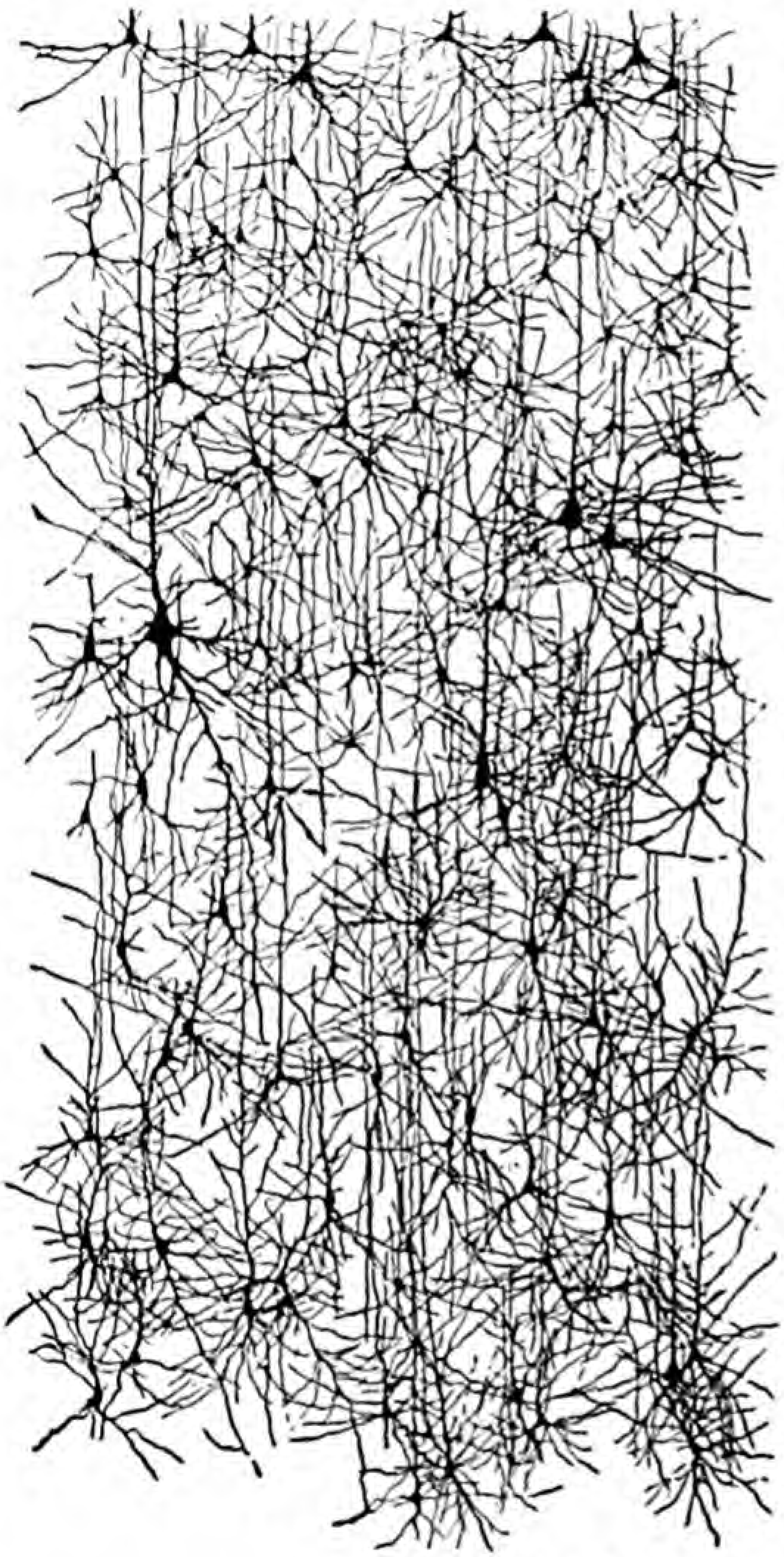
FIG. 6. — TYPES OF NEURONS

Here are shown (a) the motor, (b) the sensory, and (c) the association types of neurons.

the brain. Sever the spinal cord so that the vital organs are out of touch with the brain, and those vital organs cease to act. *In man, the most intelligent of all creatures, the brain is more dominant over the rest of the body than it is in any other animal.*

Nerve tissue is made up of neurons. — The nerve tissue that forms the essential part of the nervous system is composed of countless individual cells called *neurons*. These

cells are very small in diameter. In the cortex, or outer layer of the cerebrum, there are estimated to be approximately 9,200,000,000 neurons. In length, the neurons vary considerably, but they may be several feet long. There are neurons, for example, which reach from the foot to the upper part of the spinal cord. In a very tall man this might be five feet.



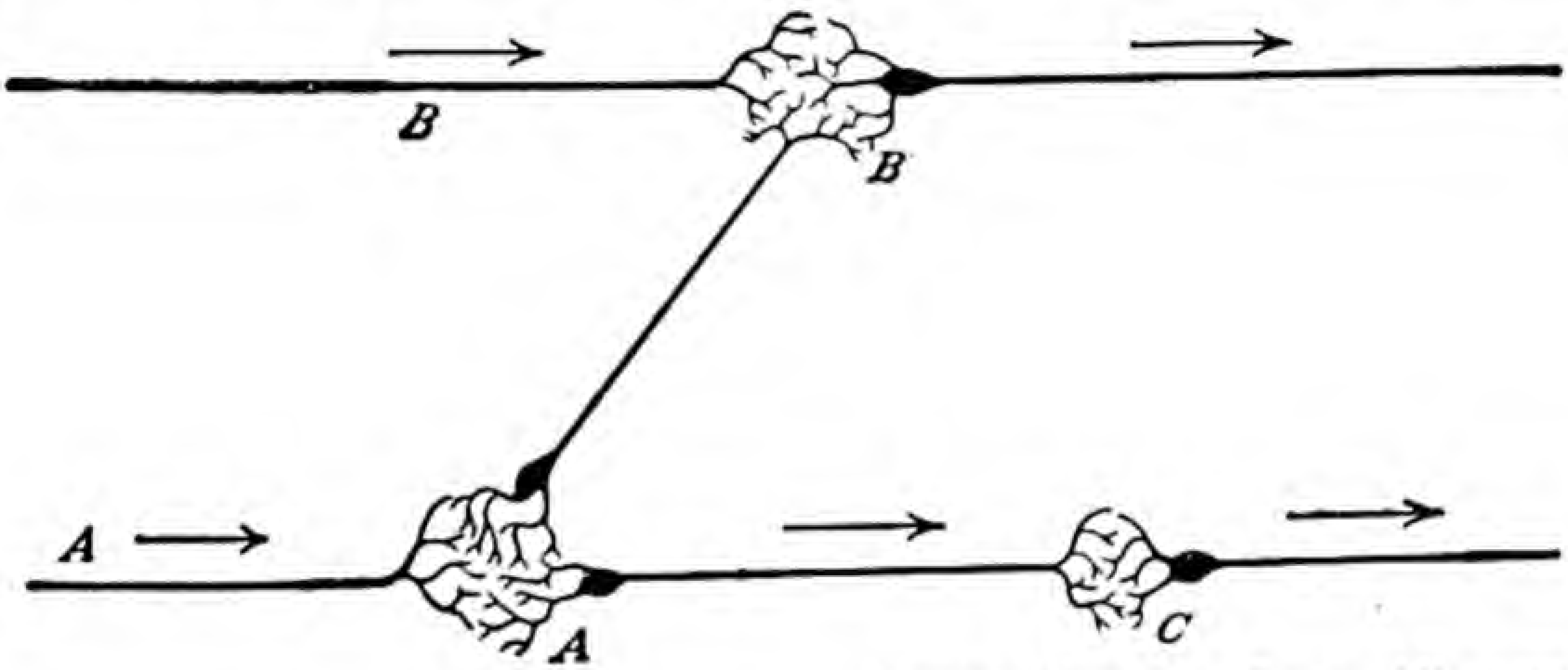
Courtesy of A. G. Seiler

FIG. 7. — A SECTION THROUGH THE BRAIN CORTEX

This drawing shows the section very highly magnified. (From Thorndike, *Elements of Psychology*. (After Kölliker.)

A single neuron is made up of one or more long processes, many fine branches, and a cell body. Where the cell bodies of many neurons are gathered together, the name *ganglion* is applied. What is usually called a *nerve* is a bundle of the straight processes. A single nerve may contain as many as 100,000 of these, for they are only from $\frac{1}{2000}$ to $\frac{1}{100,000}$ of an inch in diameter.

Impulses change their route through the nervous system. — Impulses within the nervous system are able to pass from one neuron to another. In the course of life the route taken by nerve impulses changes. That is how we learn and forget. A few years ago the sight of a spider set a certain child screaming in terror. Now the same stimulus causes laughter rather than fear. In such a case the route through the nervous system of a particular set of impulses changes. Referring to Figure 8, an impulse which has passed from



Courtesy of Longmans, Green and Company

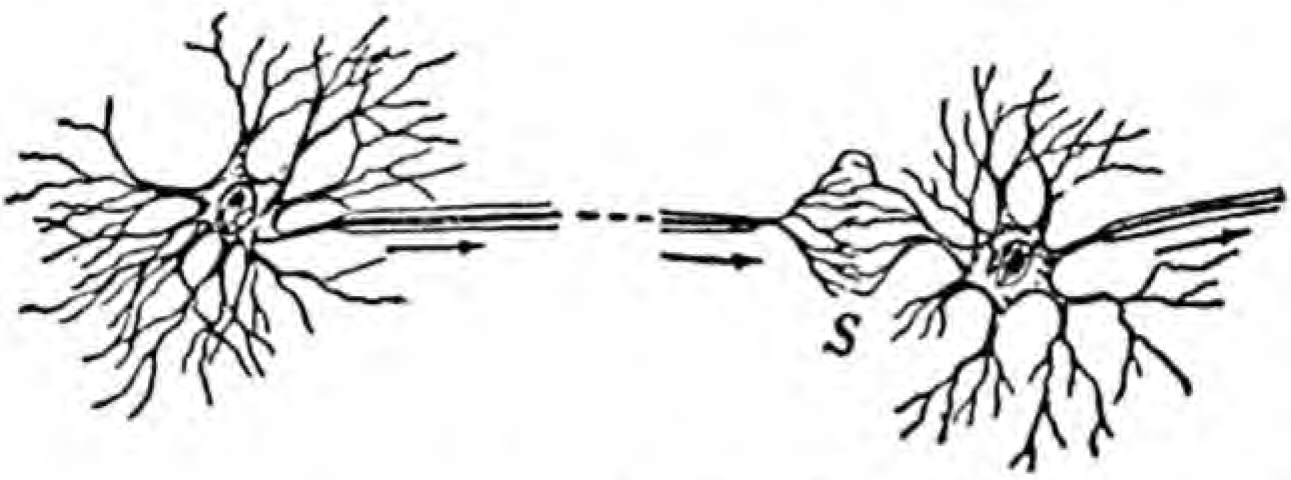
FIG. 8. — CHANGE OF PATHWAY

This drawing shows the possibility of a change of pathway from *AAC* to *AB*. (Adapted from Carr, *Psychology*.)

neuron *A* to neuron *C* might in the course of time come to pass from *A* to *B*. Of course this figure is an over-simplification of what actually occurs. Every stimulation in real life sets up impulses in a very great many neurons.

There is a theory that the change which takes place in the path of an impulse takes place at the *synapse*, that is, between the neurons. This is called the *synapse theory*. According to this theory, when a person's ways of thinking or acting become altered it means that synapses which formerly did not allow the passage of an impulse become

open, and that synapses that formerly were traversed now are resistant. Most of what we have just said is only what has been inferred about the nervous system from what we know of how people and animals act, and from what under



Courtesy of W. B. Saunders Company

FIG. 9. — A SYNAPSE, S

Notice where the ends of one neuron connect with those of another. (From Stiles, ibid.)

the microscope seems to be the structure of the nervous system. It is, however, a very good theory and many of the facts seem to support it.

We possess only general knowledge of nerve connections. — When a child learns to catch a ball, we may be perfectly certain that something has happened to his nervous system. There is no other way of explaining how it is that the sight of the flying ball comes to arouse just the hand and arm movements necessary for the catch. Eye and hand were not originally so connected, or the child would not have had to *learn* to make the catch. Clearly his nervous system has been altered so as to conduct impulses from the eye to the proper muscles in hands and arms.

But what route did the impulses follow through the nervous system when the result was a muff, and what route do they follow now that the result is a catch? This is a question to which a definite answer cannot be given. We know in a general way the route of impulses going from the eye to the brain and from the brain to the hands and arms, but we know this *only* in a general way. We cannot dis-

tinguish, in terms of actual paths traversed by the nerve impulses, the difference between a good catch and a bad one.

In the following chapters of this book we shall have much to say about habit formation. It will be well to remember that every case of habit formation, or of habit breaking, depends upon some change in the route followed by impulses going from sense-organs to muscles. It will also be well to remember that we have little specific knowledge of the pathways traversed by the impulses. Because of this latter fact we shall not have much to say about the nervous system from now on, although we shall keep continually in mind the complete dependence of behavior and mental life upon the nervous system.

The size and shape of the head tell little of character and intelligence. — It is sometimes held that the size and shape of the head reveal a person's intelligence, bravery, loyalty, and other traits. This is true to only a very limited degree. In individuals born with the effects of some disease upon them, the head and the brain within it may be very small. And such individuals are usually inferior in intelligence. In individuals afflicted with what is usually called *water on the brain*, the head may be abnormally large. These persons are likely to be inferior in intelligence. But between such extremes as these very large heads and very small heads, the size of a head tells us little or nothing of the intelligence of a person. Women's heads and brains are usually smaller than those of men, but examination of their intelligence shows that it is not inferior to that of men. Intelligence is determined by the nature of the connections between the billions of minute neurons that make up the nervous system.

If the brain thought thoughts as a muscle lifts weights, size might be of prime importance. As it is, every healthy individual has plenty of neurons, but the important thing is

the connections between these neurons. Do the impulses pass in free and orderly fashion so as to bring about prompt and efficient thought and action? This is determined, as we have said, by the connections within the nervous system, and these connections in turn are determined by heredity and by the experiences one has.

We can no more judge such traits as intelligence, bravery, and loyalty by the shape of the head — by the bumps on it — than we can by its size. The shape of the skull is only a rough indication of the shape of the brain within. Many of the uneven places on the surface of the skull are present only on the outer surface. The inner surface next to the brain may be quite different. But more important than this is the fact that brave action, for instance, is not taken care of by any particular part of the brain. Such an act involves the working together of almost every part of the brain.

Summary of the Chapter

1. Man's most distinguishing features, his behavior and mental life, are intimately related to his nervous system, sense-organs, muscles, and glands.

2. The sense-organs keep the individual in touch with what is going on within him and around him. The muscles and glands make possible his reacting to what is going on. The nervous system connects sense-organs with muscles and glands in such a way that the different parts of the body can work together. Although there are various lines of evidence showing the supreme importance of the nervous system, this system could not operate without those systems which carry on circulation, digestion, and other bodily activities.

3. The receptors, or sense-organs, are so constructed that each reacts to some force, such as mechanical impact, light,

sound, temperature changes, and internal conditions. Man has found it desirable to increase his range of sensitivity in some directions by means of telescopes, telephones, and the like, and to reduce it in other directions by means of such agencies as surgical anaesthetics.

4. The receptors are divisible into *exteroceptors* which react to external occurrences, *proprioceptors* which react to the individual's own position and movement, and *interoceptors* which react to internal activities and conditions.

5. The final result of the stimulation of sense-organs is activity of effectors, that is, muscles or glands. These muscles are divisible into those which are largely *voluntary* and those which are largely *non-voluntary*. The glands are of two types: the *duct* glands, which secrete on to the body surface or into the body cavity, and the *ductless* glands, which secrete into the blood. The more important effectors for psychology are the muscles. Man has increased the power of his muscles just as he has increased the power of his senses.

6. The nervous system, which connects receptors and effectors, is composed of two sub-systems, the cerebro-spinal and the autonomic. While these two are closely related, the cerebro-spinal system is more important for voluntary action and the autonomic for that which is non-voluntary.

7. The cerebro-spinal system has a central and an outlying part. The latter is made up of nerves leading from sense-organs to spinal cord and brain and from spinal cord and brain to effectors. The central part is made up of spinal cord and brain. Both of these are great masses of nerve-fibers within which there are possibilities for connecting practically any receptor with any effector. In man the brain dominates the activities of the entire individual to an extent unknown among the lower animals.

8. Nervous tissue is made up of nerve cells, or neurons. It is supposed by many men of science that changes in behavior, intellect, and character come about through changes in the readiness with which one neuron is affected by activity in another neuron. This is called the *synapse* theory, the term *synapse* referring to the region between the ends of adjacent neurons. Although we have a good general idea of what must take place in the nervous system, it is necessary to confess that our knowledge here is only general. We cannot say in any detail what nerve pathways are involved in this action or in that. It is clear from this that we are unable to judge intellect or character by the size and shape of the head, except in very unusual cases.

PROBLEMS

1. There are lower organisms in which a muscle cannot be moved unless that muscle is, itself, directly stimulated. Would you expect the behavior of such creatures to be simple or complex? Why?

2. Cite an instance in which your mental life was affected by your digestion. Cite another in which your digestion was affected by your mental life.

3. Make a list of all of the devices you can think of that are used to increase the power of the senses.

4. Why is intelligent action closely related to our ability to know what is going on at some distance from us?

5. Make a list of devices that are used to increase the power of the muscles.

6. Why is it an important fact that the nervous system is symmetrical?

7. What would happen to a person if his nerve impulses always took exactly the same route through his nervous system?

8. Why are we unable to judge intellect on the basis of the shape of the nose, the shape of the jaw, or the color of the eyes?

9. Practice drawing Figures 4, 5, 6, and 8 until you can draw them from memory and explain them.

REFERENCES FOR FURTHER STUDY

Parker, in *The Evolution of Man*, pp. 86–94; or *Readings in General Psychology*, Ch. II, Selection 1, p. 31 ff.

Herrick, *An Introduction to Neurology* (2d. ed.), pp. 74–79; or *Readings*, Ch. VI, Selection 1, p. 139 ff.

Dunlap, *Mysticism, Freudianism and Scientific Psychology*, pp. 130–131; or *Readings*, Ch. II, Selection 2, p. 38 f.

H. Newell Martin, *The Human Body* (10th ed. revised by Ernest G. Martin), pp. 136–137; or *Readings*, Ch. II, Selection 3-A, p. 39 ff.

Hunter, *General Psychology*, pp. 133–134; or *Readings*, Ch. II, Selection 3-B, p. 42.

Stiles, *The Nervous System and Its Conservation* (2d. ed.), pp. 28–29; or *Readings*, Ch. II, Selection 5-A, p. 45 f.

Hough and Sedgwick, *The Human Mechanism*, pp. 269–274; or *Readings*, Ch. III, Selection 4-A, p. 62 ff.

***Readings*, Ch. III, Selection 5, p. 75 ff.**

PART II

HABITS AND THEIR ACQUISITION

CHAPTER III

REFLEXES AND HABITS

A. Characteristics of Reflexes and Habits
B. Types of Habits

Questions to Keep in Mind while Reading this Chapter

1. What acts can we perform without having to learn how to perform them?

2. Why is it that certain habits are possessed by practically everybody, while other habits are possessed by relatively few?

The capacity to learn is the most distinguishing fact about human nature. The first fifteen to twenty years of an individual's life is devoted largely to learning; to gaining ways of moving, perceiving, thinking, and feeling necessary for the business of an adult human being. Animals acquire habits, but with none of them is habit formation so important as it is with man. Those animals whose lives are most complex learn what is necessary for them to learn in a relatively short time, whereas man is never through learning.

The process of learning is a central feature of human life. Every act of manual skill displayed, every item of information possessed, every ideal and prejudice with which the day's events are met, is the result of learning. No attempt to understand human nature can be successful, then, unless the principles of learning or habit formation are taken into serious account.

In the next three chapters the general principles of learning will be our topic. The completion of these chapters will by no means put an end to our discussion of the learning

process. In the present part we are to discuss the general principles of learning, and all the following parts of the book will also deal with learning. But later, we shall deal with special types of learning, such as the formation of habits of perception or thought or feeling, rather than with those general features which characterize learning of all kinds.

In Chapter VI we shall consider certain general principles that apply, not so much to the acquisition of habits, as to their operation when once acquired.

A. Characteristics of Reflexes and Habits

Reflexes are based upon inherited nerve connections. — As was seen in the second chapter, most of the action in muscles or in glands is the result of impulses conveyed through the nervous system from the sense-organs. As a rule, these impulses, set up at the sense-organs, do not spread indiscriminately to muscles and to glands all over the body. The pathways through the nervous system resist the passage of some impulses and let others through. A certain type of stimulation in the nasal passage results in the action of those muscles required for sneezing. Certain stimulations in the throat result in swallowing; others result in coughing. Now, in reflex or inherited types of action it is believed that the route of certain impulses is established at birth or develops as a part of the natural growth of the individual without regard to his particular personal experience.

Some reflexes have definite usefulness. — Coughing and sneezing remove objects or substances that threaten to interfere with breathing. Sucking, swallowing, and the secretion of saliva further the process of taking in food. The closing of the eyelid and the withdrawal of the hand or other part of the body in pain serve to protect the individual

from serious injury. These are only a few of the reflexes that serve definite purposes in life. It should not be thought that when these reflexes operate the person manifesting them has a clear realization of the purpose they serve. One of the most striking things about reflex action is that it serves its purposes without there being any awareness of what those purposes are. We may learn from study and observation that sneezing clears the nasal passage, but after we have acquired such knowledge our sneezing will work its purpose no more efficiently than before.

Among the important types of activity represented by reflexes are food-taking and elimination, danger-avoiding, locomotion, maintenance of equilibrium, resistance to external restraint, and exploration. Some of these ends continue to be served by many of the same reflexes throughout a lifetime. Swallowing, coughing, sneezing, winking, and some other reflexes change little in form or function. But the crawling, kicking, and fumbling of the human infant become extensively modified as time goes on.

Other reflexes lack definite usefulness. — Crying and smiling, both of which are unlearned reactions, do not lead as directly to definite results as do swallowing, coughing, and the other reflexes we have been discussing. Swallowing forces substances down the throat, but crying merely attracts attention. After the attraction of attention, the results of crying, and also of smiling, depend upon the training of those whose attention has been attracted. Crying and smiling finally come to suggest to others the presence of a state of feeling, but this result is achieved only because those others have themselves acted and felt in the same ways.

The inexperienced infant manifests other reflexes to which it is still more difficult to ascribe specific purposes. Consider all the random movements of hands and feet that

have no observable connection with any of the vital functions. Consider, too, the large number of vocal sounds made by the inexperienced infant which cannot even be said to express particular states of feeling.

Less definite reflexes are the materials out of which habits are made. — The more definitely useful reflexes are extremely difficult to alter. When I was a boy, there was one envied member of our group who could pour a large glass of water down his throat without stopping to swallow. The rest of us practiced this feat diligently, but we never reached the point where we had under complete control the swallowing reaction, which naturally asserts itself in such circumstances. Most of us know how difficult it is to control coughing, and sneezing is a reaction which seems impossible to prevent. It is not to be supposed, however, that these more definite reflex acts can never be changed. The catcher, behind the bat, suppresses the reflex wink. The sight of a soda fountain, which would have no effect upon the secretion of saliva in a baby's mouth, will cause genuine mouth watering in a more experienced child. But the fact remains that the modification or control of these more definite reflexes is difficult and not, as a rule, very extensive.

The less definite reflexes — the facial expressions, the vocalization, the apparently random movements of the limbs — are more readily affected by experience. It is out of them, for the most part, that the habits are constructed which play the predominant part in the life of the trained individual. The subtle changes in facial expression of the adult come as modifications of the cruder expressions of the babe; the manifold sounds of spoken language result from the modification of reflex cooing, chuckling, laughing, and crying; and the skilled movements involved in walking,

writing, handling tools, and playing games are based upon the random reflex movements of earlier life.

Some habits are useful. — Some, if not most, of our habits are indispensable aids in the business of living. Walking, talking, stopping work at meal times, thinking of four when we hear "two plus two," are acquired ways of acting which serve distinct and useful purposes. The child, as we have previously observed, would not succeed very long in the mere maintenance of life if his reflexes were not organized into habits by his personal experiences and by the instruction of parents, teachers, and companions.

Some habits are of little use or are even harmful. — All of us have acquired some habits that serve no useful purpose. A person who usually puts sugar on his breakfast food before cream realizes how strong that insignificant habit has grown to be if he attempts to reverse the procedure. Speech and dress furnish hosts of examples of trivial habits. Such expressions as "Don't you know," "As it were," and "That is to say," frequently get so firmly established in one's speech that they are employed where they add nothing to clearness, even if they do not becloud one's meaning. What is chosen in the cut and color of one's clothing as often as not has little to do with anything except one's own habits.

There are other habits, of course, that are distinctly harmful. The use of certain drugs, always seeing the faults in the conduct of others, working too hard or not hard enough, are habits that, so far from serving no useful purpose, are almost sure to lead to trouble. Such habits are not purposeless. The difficulty may lie in the fact that there are other purposes more important than those which the bad habits achieve, or in the fact that the habits bring about other results than those intended. Drugs, criticism, hard work, and, at times, abstinence from work are all capable of good.

But when drugs are used, at a great sacrifice of health, to make one forget his troubles; when criticism is applied where it can do nothing but add to one's personal feeling of superiority; when hard work means money, but the neglect of one's children; or when abstinence from work means present pleasure, but probable future want, then these habits, while serving purposes, are not serving the best or most useful purposes.

It is while learning that we are most aware of the purposes of our habits. — While a person is acquiring an act of skill he is usually aware quite clearly of just what result he wishes to bring about. Later much of this consciousness drops out. In learning to drive a golf ball the player is likely at each shot to think in detail of what he wants to do with hands, arms, feet, and club. He is likely to be aware too that he may strike over the ball or under it. As his skill increases, if it does so to any great degree, the act, at least so far as details are concerned, will become more and more automatic. The thoroughly established habit thus operates much as does a reflex.

Habits vary in fixity. — Most human acts are learned acts. That is to say, they are habits. This fact is not usually taken account of, however, because we use the term *habit* in everyday speech to designate only such habits as are very firmly established. One man always uses "How do you do?" as a greeting, while another scarcely ever carries out the ceremony on two successive occasions by means of the same expression. "How do you do?" "How are you?" "Hello," "Hello, there," may each be equally likely to issue from his lips. As a usual thing we should say, if asked about it, that the first man has an habitual way of greeting people, while the second has not. But the second man, just as truly as the first, has *learned* to greet people as

he does. The difference is that, whereas the first has a single greeting habit, the second has several. In one case the circumstance of meeting an acquaintance leads to a single, relatively fixed form of behavior, and in the other case apparently the same circumstance leads to any one of several forms of behavior.

B. Types of Habits

We have simple movement habits and systems of such habits. — When I press the button that lights my study lamp, when I step over the curbstone in coming out of the street, or when I raise my hands above my head as I dive into the water, I am displaying a simple, habitual form of movement. But not all movement habits are so simple. In fact, those we have just mentioned are parts of elaborate habit systems. The pressing of the button on the lamp is only one element in the total act of *going-over-and-lighting-it;* the stepping over the curb is an integral part of *walking-across-the-street;* and raising the hands above the head is one feature of *making-a-dive.* Most simple movements are parts of one or more complex systems of movement.

Movements are often said to exist in what are called *hierarchies.* This means that in such a complex activity as tennis playing there are a number of less complex, but by no means simple, habits, and that within these are other slightly less complex habits, and so on down to the simplest movements involved in the game. For example, the most complex activity in this hierarchy is tennis playing in general, which, of course, involves running, and using a racket. But running involves running backward, running forward, running slowly, and running fast. In a similar way, using a racket means making strokes of many different varieties, each of which is an act of skill in itself. Undoubtedly such an activity as

tennis playing, if analyzed thoroughly, could be divided into hundreds of simpler habits of many degrees of complexity.

It was once believed that our more complex habit systems are formed by first perfecting the simpler habits and then combining them. This sounds logical enough, but it does not happen to be the true state of affairs. A person does not wait until he has mastered all the simple movements involved in tennis before playing the game as a whole. In fact, it is doubtful if one could learn in that way. He may select certain strokes and practice them by themselves, but he must also practice them in their proper setting, along with the other strokes, the footwork, and the like, that make up the game as a whole.

We have simple intellectual habits and systems of such habits. — The immediate recognition of a familiar voice or face is a relatively simple intellectual act. In this case the reaction is almost as prompt as a reflex movement. But simple intellectual habits, like simple movement habits, are organized into habit systems or, as they are often called, *higher order* habits. The fact that I immediately recognize a voice or face means that I know something about a certain person. This in turn means that I have formed other habits in regard to him than the mere ability to recognize his voice or face. I probably can call him by name, tell what business he is engaged in, where he lives, and how many children he has. All of these simple intellectual acts or capacities to act are organized into a complex system which I refer to as my acquaintance with this man.

The more complex systems of movement are not built up by first perfecting simple movements and then combining them, and neither are the higher order intellectual habits mere addings together of many simpler, perceptual habits. My ability to recognize a face is not an isolated element in

my acquaintanceship with its owner, but an act the nature of which has been determined by all that that acquaintanceship means.

We have simple habits of feeling and systems of feelings. — Many objects, thoughts, and events are so closely associated with certain feelings that their presence leads without delay to the occurrence of those feelings. Just as a curbstone arouses an upward step and a familiar face an act of recognition, so a bloody wound arouses revulsion and a beautiful flower delight. It is also true of these simple feeling habits that they are frequently organized into systems of wider scope. To learn to love our country is to acquire a number of closely related and interdependent habits of feeling. As patriots we rejoice at the sight of our country's flag, become angry when our national honor is assailed, become afraid if our national progress is threatened, and grieve if our nation loses a great friend or leader. To acquire a friendship is to acquire habits of rejoicing, becoming angry or afraid, and grieving according to the varying fortunes of him who is the object of our friendship. To acquire an appreciation of literature is to learn to approve of the artistically meritorious and also to disapprove of that which is lacking in literary value.

In actual life, movement habits, intellectual habits, and feeling habits work together. — When a person has learned how to play tennis he has acquired, as we have already noted, an elaborate system of related movements. But he has also acquired ways of perceiving, thinking, and feeling which are inseparably associated with his skilled movements. He has learned to perceive in his opponent's posture the stroke that the latter is planning; he has learned to figure out what stroke his opponent is expecting from him and what he is not expecting; he has learned to enjoy a successful play

and to regret a poor one. When one becomes acquainted with another person, he acquires knowledge about that person. That is, he learns his acquaintance's name, his business, where he lives, and how many children he has.

There are in addition, however, certain ways that he comes to feel about the man. Perhaps he likes his appearance and dislikes the quality of his voice, perhaps he feels a disapproval of the manner in which his business is conducted and an approval of his home and family. Furthermore, he forms habits of movement in regard to this man. He shakes hands with him when they meet, pronounces his name on proper occasions, and smiles or frowns when his acquaintance's merits or demerits are mentioned. In other words, this acquaintanceship is considerably more than a body of knowledge. It is also composed of ways of moving and feeling. In similar fashion, an appreciation of literature involves more than ways of feeling. A lover of good books accumulates knowledge about them. He is even likely to handle them differently because of what he knows about them and because of how he feels about them.

When we distinguish between movement, perception, feeling, thought, and other forms of human activity, we do so purely to make study and description more easy. We shall not forget that human nature, as we have to deal with it in everyday life, can manifest all of these forms of activity within a single moment.

Some habits are specific and some are general. — A man may unlock the front door of his house five or six times a week over a period of years. As a result, the act becomes habitual. Not only that, but it becomes a habit of a very definite sort. This man has more than a habit of unlocking his front door. He has the habit of taking out his key ring just as he reaches a certain point on his way up the front

walk. He has the habit of holding up the ring to see which key is the one he wants. He has the habits of picking out the right key, applying it to the door, and turning the lock. And all of the movements involved in this habit, or system of habits, remain relatively unchanged. The performance of unlocking the door on one day is practically identical with the accomplishment of that result on any other day. There are, of course, a great number of habits of this definite, specific sort.

There are also many habits and habit systems which are more general in character. Even though a business man has left his house on hundreds of mornings, walked to the station, and taken the train for town, his performance of this complex act varies from day to day. Sometimes he takes one route to the station and sometimes another. Sometimes he takes a seat in the smoking car and sometimes in a regular coach. Sometimes he reads his newspaper during the journey and sometimes he talks with an acquaintance. There is, nevertheless, similarity in the general direction and purpose of his behavior from morning to morning, and for that reason we speak of his going to town as one habit or habit system.

Some habit systems are universal. — There are certain great habit systems which are characteristic of human nature wherever we find it. To care for children, to live in contact with other people, to collect objects of value, to build (whether out of stone, timber, or ideas), and to play are a few habit systems which are developed in the vast majority of normal men and women.

But such a system as acquisitiveness, for instance, is not made up of the same simple habits in different individuals. People vary in what they collect as well as in the movements they make, the thoughts they think, and how they feel while they are collecting. But most people do try to collect — or

acquire — money, cattle, land, or business enterprises, and, if they do not, they seem hopelessly out of place in this world of ours. It is true also of the other great habit systems, that the simple habits which make them up vary widely in different people. The really universal features of human behavior are not the specific acts carried out, but rather the ends which such acts attain. Methods of caring for children vary widely in different parts of the world, but whatever the specific method of handling children, children everywhere are given some care and protection.

When one of these universal habit systems is weak or absent, the result is striking. Hermits and other recluses who care only for their own company, parents who shun the responsibility of caring for their own children, hoboes who shirk the task of gathering together even the necessary goods of life, and individuals who find keen delight in wanton destruction are so unlike the usual run of people that we look upon them as abnormal. When one of these universal habit systems is overdeveloped and lacking in the restrictions that usually surround it, we are again in the presence of an abnormality. It is possible to be too good a fellow and to sacrifice everything else for the joys of companionship; it is possible for one to be so solicitous about the welfare of his children that they lose the opportunity to acquire self-confidence; it is possible to forget the proper uses of money in the sheer enthusiasm of collecting it; and it is possible to construct without any thought of the usefulness of what one is building.

Why are some habits so universal? — Why people in all parts of the world mate, look after their families, live in groups, collect worldly goods, construct houses, tools, and ornaments, and work toward other universal ends is a question which men have often tried to answer. There is a type

of person who says that these things are done because it is human nature to do them. Of course, it is perfectly clear that this is no answer at all. It is only saying that most people act as they do because most people act that way. What we really want to know is why human beings manifest the particular nature they do, rather than some other.

Calling human nature the cause of human nature is worse than a merely inaccurate way of thinking. It leads, sometimes, to our avoiding responsibilities which should be met. The indiscretions of youth, the sowing of wild oats, used to be looked upon as a natural product of human nature. The further assumption was made that, since it was a natural product of human nature, there was nothing to be done about it but to make the best of it. We now know, however, that proper surroundings and ample opportunities for the expenditure of surplus energy, as in well-regulated athletic contests, are capable of reducing to a notable degree the sowing of wild oats. There are some who think that, because there have always been wars between nations, warring is therefore a natural type of human activity, like sneezing and swallowing, and can never be suppressed. Such a belief is dangerous in that it is likely to make people give up the struggle against war. That it is false as well as dangerous is proved by the fact that great countries can, under such favorable circumstances as exist in Canada and the United States, get along without warring on each other.

There are some who think that the *instinct theory* adequately explains why certain features of behavior are present in practically the entire human race. According to the usual form of this theory the individual inherits, besides the nerve connections necessary for reflex action, far more complicated nerve connections which insure his mating, caring for his family, acquiring property, and the like, whatever be the

accidents of his education. The strongest argument in favor of this theory is that certain of the lower animals, especially birds and insects, carry out fairly complicated acts, such as nest building and finding their way back home, without any apparent opportunities to learn these acts.

To explain the unlearned behavior of these animals in terms of inherited nerve connections does not seem such an unwarranted procedure. But there are several reasons why we should hesitate to apply this theory to human nature. There are present in the human infant no complicated forms of behavior comparable to the so-called instincts. The more complicated forms of human behavior have never been known to develop except in an environment where a great amount of learning is possible. Furthermore, very unusual environments produce the so-called instincts in such unusual forms that it is necessary to believe that these instincts are more truly products of experience or environment than of inheritance. Just as bad training is capable of producing faithless parents and hermits, so it is good training that we must hold responsible for the more usual, loyal parenthood and sociable humanity.

Perhaps the strongest argument against the instinct theory is that it leads to the explanation of human nature in terms of the fact that it is human nature. If we say that normal parental behavior, normal sociability, and so on, are caused primarily by inherited connections within the nervous system, we are very likely to assume that we can do nothing to insure the development of such behavior. We are also likely to assume, if we hold to this theory, that where normal parental behavior or normal sociability fail to develop, it is because of the inheritance of bad nervous connections and that, therefore, there is nothing to be done about it.

The truest and most useful theory of the more universal

forms of complex human action is that they are acquired habits, just like the less universal forms of action. Living with others rather than alone is something that is acquired, that is no more inborn than operating a typewriter. The difference between these two habits is that we are all born into a world where we are given lessons in a social type of living, while only a relatively few persons get into a position where they can learn typewriting. We do inherit a nervous system, muscles, and sense-organs without which neither sociable behavior nor typewriting would be possible. But inheritance has not so organized us that we should manifest either of these specific activities without certain definite types of experience.

In a way we inherit what our ancestors have learned, but that inheritance is not the type that is present in our original organic structure. The knowledge of what was learned by those who preceded us is, rather, possessed by the society into which we come. By example and by word of mouth or pen one generation passes on to the next the lessons it has learned. This is often spoken of as *social inheritance.* Still, inheritance of this kind and inheritance of general bodily form are far different from the inheritance of complicated sets of connections within the nervous system which are assumed by some adherents of the instinct theory to lie at the basis of the more universal forms of human behavior. *The main reason why there are universally present elements in human behavior is that there are universally present reflexes, features of bodily structure, and features of physical and social environment.*

Some habits are typical of the particular groups in which people live. — The members of certain groups, racial, national, professional, and religious, form habits which are peculiar to the members of those groups. These habits

have to do with speech, dress, manner, and general outlook on life. So firmly do these habits become fixed that the individual is likely to conclude that they are inherently right ways of doing things. The story has often been told of the American soldier who, upon landing in France, expressed great astonishment because "over here even the little children can speak French." To him and to his companions French had always been a foreign language. The thought did not occur to him that there were people in the world who had learned their French in the same natural way in which he had learned his English.

Soon after birth the child begins to show the peculiarities of behavior typical of family, race, and nation. Some time later he learns to act like a boy, rather than like a girl, and to use the expressions and to play the games of the children with whom he is thrown. Later, when he enters upon some particular life work, habits peculiar to his profession appear. "Already at the age of twenty-five," said James, "you see the professional mannerism settling down on the young commercial traveller, on the young doctor, on the young minister, on the young councillor-at-law. You see the little lines of cleavage running through the character, the tricks of thought, the prejudices, the ways of the 'shop,' in a word, from which the man can by-and-by no more escape than his coat-sleeve can suddenly fall into a new set of folds. On the whole it is best that he should not escape. It is well for the world that in most of us, by the age of thirty, the character has set like plaster, and never will soften again."[1]

In light of all this, the importance to each of us of the groups within which we live and move is tremendous. Our race and family are irrevocably established before our birth, and we can hardly do more than make the best of them. On

[1]James, *Principles of Psychology,* Vol. I, p. 121 (Henry Holt and Company).

the other hand, many of the groups whose habits become our habits are entered by our own choice. Perhaps no acts of life are more far-reaching in their personal consequences than those decisions that thrust us among the business men, physicians, or ministers; among the luxury-loving or the frugal; among the cultured or the untutored.

Seldom does a young man, entering new surroundings and forming new companionships, appreciate fully the changes that must inevitably occur in his own character as a result of his association with this or that group. He may say to himself, as he seeks the company of spendthrifts, that he can enjoy their friendship without sharing in their extravagances; he may say to himself that he can make his way in a business shot through with fraud and trickery without, himself, indulging in such practices, but the fight he faces is a hard one and his chances of success are not great. It is a common thing in political life to see a young man start out to alter the very character of his party. In some rare instances, he does effect great changes, but as a rule it is the party that works the changes and does it in the character of the reformer himself.

The molding that character gets from each new group we enter is not simply a matter to be guarded against, not simply something that threatens our better selves. Surroundings and companions make men as well as break them. The business man or the banker of the small town often finds it valuable to work just long enough in the city to develop certain points of view and certain ways of doing things which he could not develop, save in the presence of companions who exemplify them. Fortunate is the young man, ambitious for a career as a scientist, if he can secure his training in a laboratory where others with similar ambitions are working. His own enthusiasm and his own ability will

increase in such surroundings as they never could if he were working alone, even if he had the very best of instruction.

Why do different groups of people have their own special habits? Habits are produced by experience and, since the members of any group of people have experiences shared by the members of the group but not by others, they necessarily form habits peculiar to themselves. The habits of dress of Eskimos, on the one hand, and of African Negroes, on the other, are the direct results of their experiences with climate. The pioneer's disdain for a man's ancestors and his deep concern about the man, himself, is due to the fact that, in a new country, family accumulations of property or fame cannot replace personal strength and courage in the conquest of the wilderness and all its elemental forces. But in older communities, where several generations may have gone into the building of a business or into the acquisition of culture and good taste, a man's lineage is a thing to be taken into serious account.

Membership in several groups may develop contradictory habits within the same individual. — Everyone belongs to several groups — racial, family, occupational — and most of us, especially in this complex modern life, belong to a great many. Our particular church, school, lodge, athletic club, political party, and less formal list of social companions put their stamp upon us. It is not strange, therefore, that we form habits that contradict each other. Men have at the same time held a belief in the universal brotherhood of men and the belief that those of boorish manners are unworthy of patient treatment. In this instance the contradictory habits could readily exist in the same individual if he did not happen to think of his doctrine of universal brotherhood at a time when he was tempted to shun some graceless person.

But cases arise where contradictory habits come into direct

conflict. Suppose that an officer of the law is faced with the duty of arresting a member of his own family. Loyalty to law or loyalty to family may triumph, or perhaps there may be an attempt at compromise. Perhaps, on the one hand, the officer saves his feelings by having another officer make the arrest; perhaps, on the other hand, he convinces himself that, after all, no real crime has been committed.

Some habits are typical of particular individuals. — We all have our little tricks of speech and movement that mark us off even from our families and closest friends. We have special acts of skill not common property of the members of the groups to which we belong. We have, too, our own ways of feeling about things; that is to say, we have our own temperament. These special habits make up what we usually speak of as a person's individuality. In a large measure his success in life is dependent upon them. If they are of one sort, he is singled out as a leader; if they are of another, he may be treated as an enemy of his fellows. The great public benefactor and the criminal both have formed unusual habits which make their individualities stand out from those of their fellow-men, but the particular habits, of course, are strikingly different in the two cases. We occasionally hear of someone, perhaps an actor or an athlete, cultivating personal peculiarities, as though merely being different from the run of people were, itself, a desirable achievement. Plainly this is far from the truth, unless one's ambition is to be a freak. It is worth while being different only in so far as one can be more skillful, emotionally under better control, have better taste, and be altogether, a more effective person.

Habit is an important element in individuality. — Inheriting red hair, being spoiled as a child, being unusually healthy, being disappointed in love, and all the other little accidents of life combine to establish in us those habits that are

peculiarly ours. It seems quite probable that there is something in each nervous system that makes it different from the rest. Two men with equal muscular equipment may practice typewriting for the same length of time and with the same application, yet the skill that one attains will almost surely be greater than that attained by the other. Occasionally a man whose education is undeniably meager and whose family and friends are far from inspiring will turn out to be an intellectual and moral giant. In such cases we have to assume that individuality is produced, not alone by the education and training supplied by his environment, but also by the sort of nervous system with which he comes into the world.

If two people differ in their ability to control their tempers, in their ability to sell life insurance, in their ability to run an office, or in their ability to make an after-dinner speech, to what degree shall we hold environment responsible and to what degree heredity? The safest answer to this query is that where the differences between individuals are small, environment has been the main factor in producing them, but if those differences are relatively large, then heredity may be a major cause. Most students who make 70 could be brought up to 80 with very little difficulty, and most students who make 80 could readily be dropped to the 70 group if a little more distraction were introduced into their environment. But an imbecile could hardly be made a railroad president, no matter how favorable his training, and a railroad president would hardly sink to imbecility, even in very unfavorable surroundings.

Summary of the Chapter

1. There are certain acts which seem to be provided for by nerve connections present at birth or appearing with the

natural growth of the body. These unlearned acts are called reflexes.

2. Some of the reflex acts, like coughing, swallowing, and sneezing, have a definite usefulness in the life of the individual. Others, like the random movements of legs and arms, serve no such definite purposes. Those reflexes of less definite usefulness may in the end serve important purposes, because they are readily organized by experience into habits. Speech, for example, is founded upon the random and relatively meaningless vocal expressions of the infant.

3. Some of the habits which we form make for more efficient living; some serve no useful purpose; and still others actually interfere with our efficiency.

4. While we are forming a habit we are often clearly aware of just what we are trying to do. As the habit becomes thoroughly acquired it tends to operate automatically, much as a reflex does.

5. The fact that most human acts are learned acts often escapes our notice because some of these are so variable. Only when an act is so thoroughly acquired that it occurs over and over again in exactly the same way do we realize that it is a habit. The more variable habits may be just as much habits, however, even if they are not so firmly fixated.

6. We have habits of movement, intellectual habits, and habits of feeling. It is possible to consider single movements, perceptions, ideas, and feelings as simple habits. All such simple habits are, nevertheless, organized parts of more complex systems of habits.

7. While it is useful to distinguish between habits of movement, knowing, and feeling, we must always keep the fact in mind that in actual life none of these forms of activity ever takes place entirely alone.

8. Some habitual acts are always carried out in about the same way. Others remain constant only in general direction and purpose.

9. Some of the systems of habits are present throughout mankind. Caring for the young, and construction are examples. Because these systems are so widely present, at least in regard to their ends or purposes, the assumption is sometimes made that they are founded upon inherited connections in the nervous system and are independent of experience. A better way to account for them is to consider that they are those habits which are acquired by almost everybody, largely because there are certain common features in everybody's experience.

10. Some habits are typical of the groups in which people live. This is because of certain common elements in the experience of all who live within a given group. Since no two groups have exactly the same experiences, the members of different groups differ somewhat in their habits. Some of the conflicts which arise in everybody's life are due to the fact that everybody belongs to more than one group and thus can form conflicting habits.

11. Although all the members of a group have some experiences in common, every individual also has experiences which are unique. These unique experiences account for most of the differences between individuals brought up in similar surroundings. There are, of course, other differences between such individuals which are due to their inherited constitutions.

PROBLEMS

1. Which of the following acts are unlearned, that is, independent of the individual's particular experience? Which are largely the products of personal experience? Explain why you classify each of these acts as learned or unlearned:

a. shivering with cold
b. quickening of heart beat during physical exertion
c. drinking from a cup
d. jumping in the presence of a sudden, loud sound
e. shaking hands
f. catching a ball

2. Which child would you expect to acquire most manual dexterity, one who is constantly restless and moving about or one who is more quiet? Why?

3. Mention ten useful habits which you have formed besides those given in the book. Mention similarly three useless habits and one harmful or wasteful one.

4. What is likely to happen if we think too much about exactly how to perform a thoroughly learned act? Can you explain this fact?

5. What are some of the reasons why certain habits are very much more firmly fixed than others?

6. Mention three simple movement habits, three simple intellectual habits, and three simple feeling habits besides those mentioned in the text, and indicate at least one system of habits to which each of these belongs.

7. Name three habits of your own which are definite and specific in character and three which are more general.

8. Why does all mankind build shelters? Why do different groups of men build different kinds of shelters? Why is it that no two people, even if they live in the same group, build shelters that are exactly alike? Consider the same questions in regard to the seeking of food.

REFERENCES FOR FURTHER STUDY

Jennings, *The Behavior of the Lower Organisms*, pp. 338–339; or *Readings in General Psychology*, Ch. V, Selection 1, p. 102 f.

Warren, *Human Psychology*, pp. 100–101; or *Readings*, Ch. IV, Selection 3, p. 89 f.

Readings, Ch. IV, Selection 5-A, p. 93.

Dunlap, *The Elements of Scientific Psychology*, pp. 218–219; or *Readings*, Ch. IV, Selection 5-B, p. 93 f.

CHAPTER IV

THE FORMATION OF HABITS

A. The Basis of New Habits
B. How Experience Modifies Behavior
C. Conditions Under Which We Learn

Questions to Keep in Mind while Reading this Chapter

1. What types of changes take place in our behavior when we learn?
2. Under what conditions does our behavior become most readily modified?

A. The Basis of New Habits

Habits are based upon reflexes and other habits. — When a person learns how to operate a typewriter, it is not as though a totally new form of behavior were acquired. The typist brings to her first experience with the typewriter a knowledge of spelling, a knowledge of the appearance of the various letters and numbers, and an ability to control, to a considerable extent, the movements of her arms and hands. It is out of these previously formed habits that the typewriting habit is formed. When a man studies bookkeeping, he does not develop a set of entirely new ideas and ways of thinking. In school he mastered the fundamental operations of arithmetic, and from the casual experiences of everyday life he has acquired at least an elementary notion of the meaning of profit and loss. When a child learns to walk, he has merely modified certain reflex leg movements which he inherited and certain crude habitual movements which he has previously acquired as a result of his experiments with crawling and

kicking. What one can learn at any given time depends upon what one can already do, that is, upon the reflexes and habits one possesses.

There is an old saying that you cannot make something out of nothing, but, although the truth of the matter is seldom denied, there are plenty of people who are willing to try to do just that thing. They want to get rich quickly without investing much money or much energy. Now we all know the essential unsoundness of "get-rich-quick" schemes. The odds are always against the man who is after a reward out of all proportion to the time, the energy, and the ability that he puts into an enterprise. It is equally true in regard to the acquisition of skill and intellectual ability, that something cannot be made out of nothing. The deft movements and nice adjustments of the expert tool maker are not founded alone upon care and good intentions. These movements are, so to speak, the top layer of a complex set of habits or modes of skill that have been years in the forming. The quick, sure judgments of the railroad engineer and the great business executive are not based alone upon the inherent cleverness of these men. They are habitual ways of looking at things which have been built up out of those countless experiences which have, since the first days of their careers, continuously molded and remolded their ways of thinking and acting.

Just as there are many who would make fortunes without the investment of money, time, or energy, so there are many who would acquire skill and intellectual capacity without investment, without going to the trouble of laying an adequate foundation. And, because ability is a less tangible thing than money, many think they have attained it when they have not. This is especially true of the more intellectual forms of ability. Only an extremely stupid person

would believe himself an expert wood carver or baseball player if he were really quite incompetent in these directions. But we have sufficient examples of persons of the "get-rich-quick" type who believe that their judgment on very complex matters is that of an expert.

In every business there is a beginning clerk who knows just how things should be run; in every corner store there is a politician with home-made remedies for the most intricate troubles of national finance; and in every grandstand there is a fan who can tell you all the false moves of the losing team. The difficulty in these cases does not lie in the fact that the clerk, the local politician, and the fan are thinking about problems concerning which they have no right to think. It is well when a man gives consideration even to such problems as he cannot for the present hope to solve. It is thus that men learn to think. The difficulty arises only when men fail to recognize that accurate judgments on intricate questions can come only out of broad experience. It is such experience that produces the higher forms of intellectual skill out of simple intellectual habits which are based upon *still simpler* intellectual habits. Without long practice in the simpler processes of addition and multiplication one cannot possibly make rapid calculations of compound interest. Without business experience one can hardly hope to have accurate and complete opinions about the best way of running a business.

B. How Experience Modifies Behavior

Experience makes us react to things previously ignored. — When a new habit is formed, we no longer behave just as we formerly did. There are several possible types of changes in our actions. For one thing, experience may make us react to something which previously we have ignored.

The reaction may be one that we have made, many, many times. It may even be one of those inherited reactions, called reflexes. But prior to a particular experience it was not made in the situation in which it appears after that experience. If a fairly strong electric shock be applied to a person's hand when he is not expecting it, the hand will be quickly withdrawn. In the course of a laboratory experiment it might easily be possible to surprise our subject in this way on a number of occasions. Now let us say that every time the shock is applied an electric bell is rung. After some time the sound of the bell alone may be enough to cause the subject to withdraw his hand. This is a very simple illustration of the type of habit formation wherein a reaction, which the subject has been able to make for some time, becomes connected with a new situation. In this case the withdrawal of the hand from a painful stimulus was an unlearned reflex response, but it was a reaction that did not occur upon the sounding of a bell until after a definite series of experiences had connected it with this new situation. When a reaction thus becomes connected with a stimulus which would not formerly arouse it, it is often spoken of as a *conditioned reaction*. When the reaction that is conditioned is a reflex, it is spoken of as a *conditioned reflex*.

This type of habit formation, which keeps an old reaction intact and simply connects it with a new stimulus, appears among learned reactions as well as among reflexes, among thoughts as well as among bodily movements, and among feelings as well as among thoughts. We early learn the art of hand shaking and, although the reaction itself does not become essentially changed over relatively long periods, the situations in which it operates do change. Most of the people with whom I shake hands today would not have evoked a handshake from me ten years ago, because I was

not acquainted with them then. A child learns to say or think "four" when he sees four dogs, four blocks, or the written 4. Later this speech or thought reaction gets connected with the written $2 + 2$, $6 - 2$, and even with 16. The infant shortly after birth is capable of fearing, but at first there are very few things (probably only sudden, loud sounds, and lack of sufficient bodily support) capable of arousing fear. However, as experience follows experience, this reflex feeling, or emotion, becomes connected with a wide variety of things. The business man is afraid of bankruptcy, the locomotive engineer is afraid of a red light in his path, and the student is afraid of a low mark. The capacity to be afraid was born in these individuals, but what they learned to be afraid of was a product of their individual experiences.

Experience makes us neglect things to which we previously reacted. — When a man attains a position of great responsibility, such as the presidency of an important bank, he usually learns to disregard many trivial matters which he formerly allowed to annoy him. After a man has lost some hard-earned money in bad investments, he becomes less likely than before to read every gold mine and oil well prospectus that comes his way. In each of these cases experience has decreased the power of some stimulus or situation to arouse its accustomed reaction.

But there is an important difference between the ways in which this change is brought about in the two cases cited. Little symptoms of inefficiency in unimportant employees and little extravagances on the part of his family are disregarded by the bank president, simply because he is constantly kept busy reacting to more compelling stimuli. Questions of business policy grip him until it seems that no sooner does he start to think about something of little im-

portance than something of greater importance distracts his attention. Such a stimulus as a giggling clerk loses its potency to arouse impatience because the bank president is already cogitating on the proper answer to an important letter or upon a method of checkmating his largest competitor's latest enterprise. The manner in which the investor comes to ignore questionable business ventures, on the other hand, is not quite the same. Before he lost his money he examined every investment prospectus with enthusiasm, and after that sad experience he came to neglect such things, but there is an intermediate step that must be considered. Before reaching a point where he simply ignored impractical schemes for money making, he developed the habit of responding to them in a changed, but still a very active way — by fearing and disliking them. Perhaps there was a stage in his development when he tore up with vehemence any papers on such matters that came into his hands. But as time and lack of further losses dimmed his fear and hatred, he arrived at a condition where he simply lacked interest in these fantastic schemes. Both of these men, then, learned to disregard things to which they had formerly reacted. One had this change worked in him by the entrance into his life of other more important things, while the other developed his new attitude only after a period of fear and dislike.

Experience sometimes changes the character of our reactions. — Suppose that a person can swing a tennis racket and that he also can run. In the development of his skill as a tennis player it will be necessary for him to learn to *swing-his-racket-while-he-is-on-the-run*. Thus, two habits which have formerly operated separately must now be made to operate together. Under such circumstances something more occurs than the mere combination of these ways of acting. The separate acts which are put together are almost

always altered to some degree. The swinging becomes slightly changed in form, and so does the running. This introduces another type of change which experience is capable of effecting in our behavior. In addition to making us react to stimuli previously ignored or ignore stimuli previously reacted to, experience leads to alterations in the very character of the reactions themselves.

Experience organizes our complex habit systems. — Learning, as we look upon it in our everyday life, is more than the simple matter of fixing a reaction to a stimulus formerly incapable of arousing it, of disconnecting a reaction from a stimulus which formerly did arouse it, or of blending two or more reactions. Skill in typewriting, telegraphy, drawing, or driving a car is based upon a previous possession of the capacity to make the simpler movements and judgments involved in the more complicated system of activities. The typist, as we have already seen, brings to her first lesson with the typewriter a knowledge of letters and numbers, and considerable ability to control hand and arm movements. The formation of that complex system of habits known as skill in typing comes, then, from the organization of the simpler capacities, already possessed, in such a way that they will produce the results required in work of this kind. The development of an intellectual type of skill, like bookkeeping, for example, is another case where habit formation is largely a matter of organizing simpler habits into a complex habit system. Adding, subtracting, multiplying, dividing, and ideas of profit and loss are brought together and made to work together in a way essential for the proper conduct of business.

The simpler types of learning, learning to react to a new stimulus and to neglect an old one, and the modification of the reactions themselves are involved in the organization of

reactions into systems. The chauffeur learns to steer, to accelerate, to operate his clutch and brakes so that these activities will not interfere with one another, but will make of his driving one smooth, organized process. However, this is not all. Even such a simple activity as steering must be modified within itself. The learner, unless he has had considerable experience in steering a bicycle or other vehicle, makes his turns too sharp or too wide, makes great detours around objects not really in his path, and fails to avoid the hump in the road. His education as a driver, before it is complete, must teach him to steer around formerly neglected places and to neglect turning or detouring where it is unnecessary. In a like manner, other simple elements in the complex habit system of automobile driving require their own modification. The unskilled driver lets in his clutch suddenly instead of slowly and gently, and jams on his brakes so as to lock his wheels and wear off much good rubber. In the acquisition of skill, if the learner really progresses, steering, braking, and the rest will become more and more perfect in themselves as well as better fitted into the system of habits that make up automobile driving.

It was noted in Chapter III (pp. 52) and may well be repeated at this point that the simpler changes in stimuli and reactions take place, not before, but along with, the larger processes of organization. From the first the new chauffeur begins to learn, not only how to operate brakes and clutch, but also how to operate them together.

C. Conditions Under Which We Learn

Problems produce new habits. — A gentleman had always bought his suits and overcoats at one or another of two local stores. But one fall he set out for a suit of a particular kind of cloth. He went to Number 1 of his regular places, but

failed to find what he wanted. With little hesitancy he visited Number 2, and here again he was disappointed. By this time a real problem had arisen to which he must adjust himself, either by changing his ideas of what he wanted or by looking about until he found it. Having chosen the latter alternative, he finally found what he wanted and purchased it. His immediate problem was solved, but important further consequences developed. He had made a purchase in a new store, and the next time he needed a suit he felt a tendency to return to that store rather than to either of the two where he had once been accustomed to buy. His shopping had produced, not only a solution for his immediate problem, but also a new buying habit stronger than his former ones. Of course, under similar circumstances a new habit would not always take form; he might conceivably have returned to one of the old stores for his next purchase. The significant fact is that the problem — his inability to get what he desired by going where he usually went — produced a new act, and that this new act stood a very good chance of becoming a strong and definite habit.

One of the best methods for producing more efficient habits in an individual consists in making him see that his present habits do not produce the results they might. It is commonly said that one improves most in such games of skill as tennis if playing against an opponent who is more skillful, though not so much so that one can entertain no thought of some time beating him or, at least, of giving him a tight match. Under such circumstances one is alive to anything that is likely to improve his play, whereas if the opponent is always easily beaten one is likely to become careless, the bad elements in one's play become fixed with the good, and there is an end to improvement. Many business houses

have found it wise to let each salesman know how his sales compare with those of company leaders. Such a practice is likely to make thoughtful the man who is falling behind and to make him modify for the better his habits of selling. If he were unaware that anyone were doing better than he, the business of selling might present no pressing problems, and his chances of developing new and more effective methods of work would be slight.

Prejudices and narrow-minded views of things may often be supplanted by fairer habits of thought simply by showing that they are not solutions for the problems they pretend to solve. The salesman out on the road selling goods may maintain a habitual attitude of intolerance toward the home office because goods are not shipped and letters forwarded as promptly as he thinks they should be. The home office, on the other hand, may get into the habit of discounting the salesman's every complaint without investigating its justice. The attitude of each toward the other might be improved if the salesman only had a true picture of the problems confronting the office and if the office only had a true picture of the problems of the man on the road.

Habits are formed through instruction. — The salesman who realizes that he is not turning in as many orders as he should is faced by a problem that can be solved only by finding new and better sales methods. Showing him that he is not doing as well as some of his colleagues may make clear the problem and start him thinking about ways to improve. But this is only a beginning. He will probably make many mistakes in his efforts to improve unless he be given at least a few hints about the sales methods which have in the long run proved best for men handling his particular commodity and dealing with customers like those with whom he deals. In other words, instruction at the

proper time will greatly facilitate the formation of new and useful habits.

Instruction is most useful where it gives the instructed person the benefit, not only of his own past habits, but also of those of many other persons. Modern methods of typewriting, stenography, bookkeeping, salesmanship, and business management have been worked out from the experiences of hundreds of people and the best ways of doing these things have survived. By means of instruction these best methods can be passed on.

In teaching a child to walk, we usually give him support and swing him along in such a way as to produce the necessary leg movements; in teaching him to throw a ball, we grasp his arm and force it to move in an approximately proper manner; and even when we teach adults to dance or to drive an automobile, provided they are completely lacking in previous training of this sort, we are likely to take hold of them and secure correct action by physical force. This primitive, but frequently very effective method of instruction may for convenience be called *physical* instruction.

Especially in the acquisition of manual skill, constant supervision is necessary during the earlier stages of the learning. Where the pupil is intelligent, however, and already has acquired other habits not too unlike the one in question, *physical* instruction may be replaced by *verbal* instruction — by telling the learner which of his acts are correct and which incorrect. This method has certain obvious advantages. It saves effort for the instructor and, what is more important, it enables the instructor to stand off from the learner, so that a better view of the latter's actions can be had. A football coach would not get very far with the training of his team if he had to use physical

instruction as his only method. Because of the possibilities of the method of instruction it is possible for him to stand off where he can watch the team as a whole and give instruction as it seems to be needed, now to this man and now to that. Where manual skill is concerned it is, of course, seldom possible or desirable completely to replace the method of physical supervision. If the halfback's grip on the ball or the tackle's method of charging is radically wrong, verbal advice is not the most effective method. Under such conditions, the good coach actually places the ball in the correct position in the back's hands or pushes the head, shoulders, and feet of the linesman into proper positions.

Habits are formed through imitation. — Much learning is done by *imitation*. Young golfers often improve their game by watching the strokes of experts and copying them; young authors sometimes develop their own literary style by imitating first one and then another great writer; and young scientists are found imitating every manner of their master. Imitation is a popular method in the business and industrial world. New salesmen are in many cases introduced to their work by being sent out with an expert in order that they may copy his sales methods. The efficiency of a group of machine operators can sometimes be improved by picking out that one of them whose production records are best and encouraging the others to study his methods of work.

Acquiring skill through imitation is greatly facilitated by photography in its various forms. If the expert performance can once be put into a motion-picture film, it can be repeated indefinitely for the benefit of many more learners than could possibly watch the expert himself. Only a short time ago there was presented in the United States a series of motion pictures of surgical operations performed by world-famous surgeons in one of the great hospitals of Europe. The

students who saw these pictures were able to study the methods of expert surgeons whom they could not otherwise have seen unless they had taken a trip of several thousand miles, which would for most of them have been impossible. Furthermore, they were able to see within a short space of time operations which, even in one of the largest hospitals in the world, would have been performed only at rare intervals.

It is sometimes difficult to study an act of skill because the action runs so quickly. The ordinary motion picture does not solve this difficulty, but the so-called "slowed-up" pictures help a great deal. The swing of the expert batsman reveals, in the "slowed-up" pictures, numerous features which are unobservable when the swing is seen at its actual speed. Where it is desirable to study with special care certain particular points in the execution of a skillful act, a series of stationary photographs are of considerable assistance. By means of one of the highly sensitive cameras designed especially for such purposes, rapidly moving objects can be brought out almost as clearly as stationary ones.

While there is no doubt that learning is often aided by imitation, there are certain results of this type of learning which need to be guarded against. When we watch the expert, we are prone to think that every move he makes contributes to his efficiency, whereas the truth of the matter is that the best machine operator, salesman, executive, or athlete has many little habits that keep him from attaining still greater success. And in consciously imitating the expert we are likely to acquire his faults as well as his virtues. Talented men, simply because they were too closely copied, have passed on to their admirers such detrimental characteristics as rude manners, uncouth dress, and exaggerated self-esteem

as well as industry, thoughtfulness, ambition, and the other traits that have actually made them successful.

Traits that help one man to great achievements will not always do the same thing for other men. An insurance agent kept himself in the public eye and undoubtedly increased his sales by loud talk and louder clothes. But nine out of ten young men who copied such strategy would come to grief. This agent succeeded only because he had a keen sense of humor and a natural friendliness (traits less easily copied) which went along with the loud talk and the loud clothes and made them assets rather than liabilities. Golf instructors have long said that imitation is one of the best methods of acquiring a good game, but the wiser ones have added that we are headed for trouble unless we copy the play of those who are not only good players, but also possess approximately our own bodily build. The fat man cannot use to advantage the swing of the lither one.

If we propose to learn by imitation, then, we should copy only the essential traits of the expert and those only if there is reason to believe that they will fit in with our own peculiar traits. In other words, such imitation should be thoughtful and not blind.

The best instruction is sometimes very remote. — When the child's attempts to walk are under the direct physical control of an adult, when the football player's moves are subjects of verbal comment by the coach, and when the salesman learns his sales talk by listening to the actual sales talk of a more experienced man, instruction is very immediate in nature. But when the coach explains at a blackboard a play to be put into execution on the morrow, or when one reads, during school days, facts about notes, stocks, bonds, rates of exchange, contracts, leases, and the like, most of which will not be used until several years later,

instruction may be said to be of a very remote sort. The ability to profit by such remote instruction is, of course, one of the marks of an educated man.

One can hardly become a successful farmer or shoe manufacturer simply by reading books or listening to lectures on these subjects, but much can be learned in that way, and what can be learned can often be learned quite quickly. Such instruction can go on far from the farm or shoe factory and still accomplish much. It can so prepare the learner that when he goes on the farm or into the factory where more immediate methods of learning are possible, he can profit better by them. A certain New York banker is constantly called upon to exercise his judgment in regard to many kinds of businesses. Not long ago he was suddenly requested to take a hand in the affairs of a coke company. He knew that he would be at a disadvantage unless he learned something about coke production and learned it quickly. He had no time to go out and actually observe this industry in operation. He had to read, and by reading he was able to become at least intelligent about this business. He is often confronted with similar situations where he has to learn quickly and without leaving his own office. In all these cases he learns by the remote methods of reading or talking to someone who has had first-hand experience with what he wants to know.

Too much learning from others is not good. — While physical instruction, verbal instruction, imitation, reading books, listening to lectures are important factors in habit formation, they are sometimes employed where it would be wiser to present the learner with a problem and simply let him work it out for himself. No matter how many useful habits are acquired by watching and taking instruction from others, there is one very bad habit which may easily be

picked up at the same time — the habit always of expecting someone else to decide how a situation is to be met.

A naturalist who taught elementary zoology furnished each of his students with a crayfish and a set of dissecting instruments, and directed them to study the creature, but no hint did he give as to how they were to make that study nor as to what facts they were to give particular attention. Now this procedure was, of course, a very foolish one, because his students spent most of their time observing insignificant facts. If the naturalist, before giving his students the crayfish to dissect, had talked to them about similar animals and in other ways had furnished them with hints about how their study was to be carried on, he might have obtained very good results. Learning through problem solving is often the best method of learning, but it requires that the problem be one that the learner is really prepared to solve. Otherwise the method is quite as likely to destroy independence and self-confidence as it is to establish those habits of mind.

Many habits are acquired without our intending to acquire them. — When there is a desire to learn, habits are, as a rule, acquired more quickly, but learning frequently takes place without such desire being present. "An Englishman," says Fry,[1] "goes to reside in America or in Ireland, and after a few years, or even months, acquires the peculiarities of expression, the delicate differences of utterance, which separate the speech of his place of residence from that of his place of birth. In this case there is no question of volition; he probably desires to retain his national pronunciation; there is no consciousness, for he is generally surprised, if not annoyed, at being told by his English friends that he has

[1] Quoted by Professor E. A. Ross in *Social Psychology*, p. 124 (The Macmillan Company).

acquired a new dialect or brogue." A number of examples have been given of how the habits peculiar to a group take hold of persons coming into that group (pp. 59). And as often as not the newcomer either has no intention of forming these habits or has definitely decided not to form them. Many of the mannerisms of the young commercial traveler, the young doctor, the young minister, or the young lawyer are acquired without any appreciation on the young man's part of what is happening to him. The high-minded man, who enters a political party to reform it, is as astonished as anybody when he realizes, after some years have passed, that the traits which he had intended to remove from his party have become incorporated into his own character.

In the discussion of learning by means of imitation we have noted that, unless one is on his guard, he is likely to acquire the faults as well as the virtues of another's actions. This is partly due to mistaking faults for virtues, to assuming that everything a competent man does must be worth copying. It is also due to the fact that we acquire these faults without stopping to consider whether they are or are not worth copying.

Useful and important modes of action, as well as eccentricities and faults, are acquired without effort or intent. The child learns to speak his native tongue, to distinguish between up and down, to know the ordinary articles of food when he sees them, without being aware that he is learning or even that he desires to learn. In the acquisition of typewriting skill it has been found that many of the little details necessary for the rapid production of accurate work are picked up without the knowledge of the learner. Some time later he may notice that his work is greatly aided by a little trick or movement that he did not know he had acquired.

There are instances where very complex types of skill are

gained without the learner's knowledge of what is going on. The so-called *muscle reading*, at which some people attain remarkable competence, furnishes good examples bearing on this point. The procedure in muscle reading, it will probably be remembered, is something as follows: The *reader* is taken out of a room full of people and kept under close guard. While he is away the people in the room decide upon a certain object, let us say a watch in the upper left-hand vest pocket of one of their number, which is to be found by the reader upon his return. They also select another of their number whose arm the reader may grasp, but who is not in any conscious way to give a hint of the nature or location of the object about which the group is thinking and which the reader must find. The one whose arm is held will not, if he honestly keeps his mind upon the watch, be able to prevent slight and unconscious movements of his arm which will guide a skillful muscle reader to the object sought. But far stranger than the fact that one can learn to read these unconscious movements is the fact that the muscle reader rarely knows just how his feat is performed. A woman at one time had a high degree of this peculiar skill and little or no precise knowledge of its nature. Finally she became curious and decided to observe herself very closely while she was making the muscle readings. Her efforts, however, were not very successful, for when she paid close attention to the movements which were furnishing her cues they meant nothing to her.

Muscle reading is, of course, an extreme example of skill acquired and operating without any awareness of its exact nature. But even in ordinary life the same general effect can frequently be noted. There is a popular but quite fallacious belief that anyone capable of performing skillfully is, therefore, able to describe the details of that performance.

No variety of skill has been described more often by expert performers than golf playing, and these descriptions, although they do contain much truth, are replete with pleasant fairy stories. The fairy stories are especially likely to concern those elements in the stroke of which the player himself cannot be conscious.

Important elements of character are often picked up unconsciously. The possessor of them may go through life without ever being aware of their existence or importance. Schools and colleges sometimes invite successful professional and business men to tell about their lines of work and the requirements for success in them. If a man, before making such a talk, sits down and asks himself what features of his own character have really been accountable for his success, he is likely to find that his knowledge of the subject is extremely vague. A successful lawyer once said that he had succeeded largely because, in all his career, he had never failed to judge correctly anyone with whom he had dealings. One does not need to know much about human nature to realize that such a record of character judging would be impossible. There are two reasons why this lawyer said what he did (and almost certainly he himself believed it to be true). In the first place, he had not kept accurate account during his life of just how good his judgments of character were, and, in the second place, being unable to analyze out the genuine causes of his success, he picked out this one which, because he saw no fallacy about it, seemed to him quite acceptable.

Summary of the Chapter

1. Habits are formed upon the basis of reflexes and habits already possessed. In other words, what we are able to learn is limited by the nature of our past accomplishments.

2. As a result of experience we learn to react to things

previously ignored. In such a case we do not acquire a new reaction, but we connect an old reaction with a new situation. Reflexes and habits which thus become attached to new situations are called *conditioned reactions.*

3. As a result of experience we come to neglect things to which we previously responded. This may be due to the fact that other more urgent matters may command our attention or to the fact that our reactions to certain things have had unfortunate consequences.

4. Experience sometimes brings about a combining of two or more reactions in such a way that the reactions modify each other. Thus the running we do while swinging a racket is not exactly like that done without the swing, and the swing we make while running is not exactly like that made while standing still.

5. Learning is favored by problems which our customary ways of acting do not enable us to solve. Failure to improve our efficiency is frequently the result of our not seeing problems which actually confront us. After a person has apparently stopped learning, it is sometimes possible to start him learning again simply by confronting him with a problem.

6. Learning is usually rendered quicker and more effective if aided by instruction. This instruction may take the form of verbal advice or of actually forcing the learner to make the right kinds of reactions.

7. Skill is also acquired by imitation. To be successful, however, the imitation must be intelligent. Otherwise the learner will acquire the faults as well as the virtues of him who is being imitated. The imitator must also take into account the fact that no two people can accomplish the same results in exactly the same manner.

8. There are many cases in which learning must take place under circumstances which are remote from those in which

the learning is to be put in practice. This type of learning is seldom complete, but it is often the only feasible one.

9. Learning with the aid of others is convenient, but it should not be relied upon in too great a measure. One should have some practice in figuring out for himself the best ways of doing things. The aid of others should be sought chiefly where one lacks preparation sufficient for effective independent learning.

10. Useful and important kinds of learning frequently go on without the learner realizing that he is acquiring new habits. For this reason a skillful person may give a totally erroneous description of the real nature of his own skill.

PROBLEMS

1. What reflexes and habits must one already possess before he can begin to learn to play baseball?

2. Can a man with good intentions but with little or no special experience become an able statesman? Explain your answer.

3. Enumerate ten conditioned reactions that experience has developed in you.

4. Tell about a stimulus to which you no longer react because of the greater importance of other stimuli. Tell about a stimulus to which you no longer react because your former reactions to it resulted unpleasantly.

5. Give an illustration from your own life of where the bringing together of two reactions has altered each of them.

6. In what sense is the memorizing of a poem largely a matter of organizing what we already know?

7. What type of problem will be the greatest stimulant to learning: one which is extremely hard, one which is extremely easy, or one which is hard, but not so hard as to be beyond the ability of the learner?

8. Learning can take place without instruction, but why is it difficult to acquire expert skill independently?

9. Where skill is to be acquired by imitation, what kind of a person should be selected as a model? Ought skill to be the only basis of selection? Or ought account be taken of the fact that someone not quite so skillful may be more successfully imitated?

10. Why are there law schools? Why do we not depend entirely upon lawyers learning law in the actual practice of it?

11. There was once a famous school master of inspiring personality whose students, while in his school, had the reputation of being an exceptionally well-behaved group. But strangely enough, this same master's students also had the reputation of getting into more than an ordinary amount of trouble after they left his school. Can you think of a possible explanation?

12. Enumerate several habits that you have acquired without your being conscious of the fact that you were acquiring them.

REFERENCES FOR FURTHER READING

Hough and Sedgwick, *The Human Mechanism*, pp. 85–87; or *Readings in General Psychology*, Ch. IV, Selection 4, p. 91 f.

Watson, *Behavior, An Introduction to Comparative Psychology*, pp. 184–187; or *Readings*, Ch. V, Selection 2, p. 103 ff.

Carr, *Psychology*, pp. 84–85; or *Readings*, Ch. V, Selection 3, p. 105 f.

Book, *The Psychology of Skill*, 2nd ed., pp. 230–248; or *Readings*, Ch. V, Selection 6, p. 118 ff.

CHAPTER V

THE FIXATION AND ELIMINATION OF HABITS

A. The Rate and Limit of Learning
B. The Curve of Learning
C. Features of Established Habits
D. The Elimination of Habits

Questions to Keep in Mind while Reading this Chapter

1. What factors determine the rate and limit of habit fixation?
2. What are the marks of thoroughly fixed habits?
3. How are habits lost?

A. The Rate and Limit of Learning

Discovery of a new way of acting only the first stage in the learning process. — Habit formation is merely begun, when, through the solution of a problem, through instruction, or in some more incidental fashion, we hit upon a new way of acting. Such action, before it can become an established part of us, must go through a process of fixation or stamping in. This may take a long time or a short time, depending upon a variety of conditions, some of the more important of which will be considered in the present chapter. We shall also discuss in the present chapter how habits are lost.

The rate at which we learn depends upon what habits we already possess. — In the first place, the fixation of a habit is affected by what other habits have previously been acquired. We have already touched upon this subject to the extent of showing that certain acts of manual and intellectual

skill cannot be acquired at all unless the learner has previously developed habits which are capable of forming a foundation for these later ones.

Adding is learned more quickly if the child already knows how to count, and multiplying is learned more quickly if he already knows how to add. This is so evident that we teach counting first, then addition, and, some time after addition, multiplication. Bookkeeping comes many times as quickly because it is studied only after arithmetic is fairly well understood. One movement habit may likewise facilitate the acquisition of another. Think of trying to learn to dance or to skate before learning to walk! When, as in these cases that we have mentioned, an established habit or habit system aids us in fixating another habit, we say that there is a *positive transfer* from the first habit to the second.

It is, of course, important to know where we can expect positive transfer and where we can not. While positive transfer from counting to adding, from adding to multiplying, from ordinary arithmetic to bookkeeping, and from walking to dancing or skating is very marked indeed, there are many situations where the facts are not so clear. No one would question the advisability of teaching counting before adding. Not only is the existence of positive transfer evident here, but there is certainly nothing which could efficiently replace counting as the forerunner of addition. Difficulties begin to arise when two or more habits or systems of habits promise to transfer equally well to another habit which is to be fixated. Will the study of history or of literature better prepare a man to learn about human nature as it manifests itself in the banking business? There is a question that is hard to answer!

We are fortunate enough to know, in a general way, how this positive transfer operates. The more alike two habits

are, the more positive transfer there will be from one to the other. Both counting and adding involve an elementary understanding of the meaning of numbers. Therefore there is a marked transfer between them. A knowledge of English probably helps more in learning French than does a knowledge of Greek, because there are hundreds of English and French words which are spelled in the same way.

Transfer often takes place simply because two lines of activity are alike in general principle. The actual movements required to steer a bicycle by means of its handle bars and an automobile by means of its wheel are very different, but the general principle is the same. For this reason, anyone who knows how to steer a bicycle is almost sure to learn to steer an automobile quite easily. He who once learns thoroughly the principle that large business ventures backed by insufficient funds are fundamentally dangerous will find that principle helping him to master and evaluate each new business with which he comes into contact.

Very often transfer fails to take place between one habit and another, because the general principle of the first habit is imperfectly understood. A man may realize that in his line of business, ventures which have both the safety and promise claimed for the oil investments that are offered to Tom, Dick, and Harry are usually offered to only a few. But unless he understands this as a general principle, it may fail to transfer from his knowledge of his own business to his knowledge of oil wells and gold mines. In that case, it may take actual financial loss to fixate the fact that the general public is no more invited to share in the more profitable undertakings connected with oil and gold than it would be in his own line of business.

From these facts it is apparent that the well-trained man is he who has mastered, not only a wide variety of habits,

but also the general principles underlying them. Through his understanding of these principles he is able to apply his acquired knowledge and power to the gaining of new knowledge and to the achievement of new ends.

Old habits, and reflexes too, occasionally interfere with the rapid fixation of a new habit. Some people are never able to fix the habit of sitting quietly and relaxed in the dentist's chair. Just as this habit of calm begins to assert itself, the patient either actually experiences pain or expects it, whereupon his muscles tighten reflexly and the habit of calm receives a definite setback. During the early years of a child's arithmetical studies, when he is always dealing with whole numbers, the product of a multiplication operation is invariably equal to, or, greater than either the multiplicand or the multiplier. Then he comes to deal with fractions, and this general principle, which has become a habitual mental attitude with him, no longer holds. He has to learn to expect the product to be smaller than the multiplicand, and his learning is constantly being blocked and interfered with by the older and more firmly fixed way of thinking about multiplication. This interference of old with new habits of thought is even more marked when the child learns division by fractions. That the division of a number by any other number, even a fraction, should give a result greater than the number divided seems incredible to some people all their lives. The reason for the difficulty of this apparently simple fact lies in the great strength of the habit, fixated when whole numbers alone were dealt with, of expecting the result of division to be smaller than the number divided. When a habit already formed interferes with the fixation of a new habit, this effect is called *negative transfer*.

It sometimes happens that an athlete, let us say a runner, suddenly ceases to improve, although he obviously has not

reached the limit of his physical strength. Under such circumstances the experienced coach or trainer makes a careful study of the man's way of running in order to discover what habit has been picked up which could interfere with the development and fixation of the finer points of form upon which later improvement depends. In other words, he assumes that a negative transfer effect lies at the bottom of the trouble. As soon as he discovers what old habit is interfering with progress, he sets the man to battling with that old habit until it is so worn down that it no longer interferes with the new habits that must be fixated if skill is to be increased.

Habits are quickly fixated if in line with our general interests. — Slight grammatical errors, if they have been present in one's speech since early childhood, are all but impossible to correct. Yet a man, well along in the twenties at the time, was told by a friend that he habitually said "It don't" and "He don't" instead of using the singular "doesn't" with those pronouns. Almost immediately his incorrect habit became supplanted by a correct one, and the promptness with which the new habit was fixed was undoubtedly due to the fact that this man had a very strong desire to speak accurately. The necessity of improving his speech had not previously been brought to his attention, probably because in most ways it was fairly good, but when those errors were pointed out to him it seemed as if all the force of his ambition to be well educated went into hastening the fixation of new and correct habits of speech. Give a man an interest in salesmanship, and it is astonishing how readily he will develop all the tricks of his trade. The slightest hint of a better selling method will be caught up by him with apparently no effort at all.

Most people have a few general interests that facilitate

their learning in certain fields. The average man becomes interested enough in some business, and possibly also in some sport, to pick up skill and information along those lines quite readily. The average woman, likewise, learns readily anything pertaining to housekeeping and to social life. But no matter how clever the man or woman may be, more and wider interests are required if real intellectual power is to be developed, because wide interests assure easy learning over a wide range of subjects.

It is not difficult to see that a deep interest in banking or farming, for example, makes for the ready learning of anything pertaining to those subjects. It is also clear that, if interest is such an aid to learning, it is highly desirable to be interested in anything we really wish to master. But how are we to acquire this interest before we are acquainted with the subject to be mastered? As soon as we appreciate that banking is worth understanding, we have the beginning of an interest, although not much more than that. Before this interest can grow to sufficient proportions to make learning really easy, learning itself must be begun. That is, a few facts already learned are the best foundation for an interest which will make the learning of additional facts relatively easy.

Many people think they have a strong interest in a business or profession, but when they undergo a little training in it, they realize that their interest has not actually been in the business or profession as it really is, but only in the very limited view of it that they have had from the outside. An interest in salesmanship, prior to actual work along that line, might easily rest upon the fact that, as a salesman, one is likely to travel and see much of the country. Such an interest might not, however, help the learning of good sales methods. Since this interest is in travel rather than in

salesmanship, it is likely to prove a distraction and a source of disappointment, because one's actual interest is not really in line with salesmanship as it really is, but as he has falsely pictured it.

Of course there are cases where an interest based upon a false or one-sided notion of an occupation does aid to a certain extent in getting the beginner started. Sheer love of travel might keep the young salesman at his job despite such irksome features of it as learning many facts about his line of goods and his customers, until he has acquired enough information to form the basis of an interest, not in mere travel, but in his work. From that point on, the way is clear. Still, such a transfer of interests is sometimes a dangerous thing to count on, and it is well, before entering the long period of training that is required for success in any line, to take stock of the basis of one's present interest, if he has one, and to try to foresee just what changes in interest the training is likely to require.

Habits are quickly fixated if their results are pleasant. — Every animal trainer understands the importance of the sugar lump or the piece of meat after a trick successfully performed. Experiments have shown definitely that school children will learn faster if a reward is offered for unusual achievement. Encouragement and praise will stimulate the learning of even the most sophisticated adult.

It is important to note that there are various kinds of pleasure and that some of them will carry our learning further than others. A stick of candy given for each achievement in arithmetic will spur on the little child to greater and greater improvement, but a time is sure to come when that reward will lose its effect. Words of praise, too, are prone to lose their power of stimulation if they are given time after time by the same person. Perhaps the most effective

pleasure in the long run is that satisfaction one gets from knowing when his own work is well done. If one is taught to take satisfaction in each bit of progress and continually to move up his standard so that it takes a little further progress before he will again be satisfied, we have a kind of pleasure that will spur on the learner even if no one remembers to give him a stick of candy or to praise him. It is such pleasure alone that can keep a man developing himself along lines that others do not appreciate or understand.

The failure of progress to result in pleasure which will lead to further progress is sometimes due to erroneous expectation on the part of the learner. The man who enters a business with the idea that every time he increases his skill and knowledge he will immediately be rewarded by the praise of his superiors, an increase in salary, and a promotion to a position of larger responsibility is doomed to disappointment. If his learning is dependent upon continuous pleasures or rewards of that kind, it is likely to be blocked by the lack of them. The world of business is full of young people who are drifting around from one job to another because they cannot find sufficient rewards for their slightest signs of progress. The difficulty does not lie so much in the fact that they hope for pleasant consequences from whatever progress they make as it does in the fact that they expect a type of pleasurable consequences that can come only at intervals. They have not acquired the ability to enjoy progress for its own sake. The machine operator, working on the *piece rate* system, where he is paid for each article produced, may look for an extra amount in each week's pay envelope while he is increasing his skill. The highest types of ability in industry, on the other hand, bring, while they are developing, much less frequent and direct rewards.

The acquisition of sound business judgment comes slowly, and its progress cannot accurately be judged and rewarded at the end of each week. If sound business judgment be the goal, then, it is especially necessary to realize that the only source of daily or weekly pleasure of progress must come from one's own satisfaction in the fact that learning is really going on and the knowledge that the other more tangible rewards are sure to follow in due time.

Habits are quickly fixated if they save us from unpleasant consequences. — The animal trainer knows the value of the whip as well as that of the sugar lump and piece of meat. Whatever we think about the mental and physical punishment of children, we are forced to admit that punishment has played an important part in the education of most people. As life goes on, there are no longer spankings and scoldings to protect the integrity of our better habits, but many of our habits continue to become more and more firmly fixed because they protect us from the unpleasant results which would issue from other forms of action. For the adult, there is often unpleasantness enough in the mere thought of someone else's bad opinion to keep him developing in one direction rather than in another. He may even form such strong ideals of what he should achieve, that his failure to live up to them will bring him the keenest kind of disappointment, and turn him, more surely than would anything else, toward the cultivation of more efficient habits.

Few of us would keep on acquiring skill and knowledge indefinitely without something corresponding to the sting of the animal trainer's whip, and few of us would ever learn as quickly as we do, if it were not for such a sting occasionally applied. Of course, if one is ridiculed or scolded for every little false step, discouragement is almost sure to appear, and with its appearance progress is almost sure to cease. But

as soon as false steps fail entirely to bring at least a mild chagrin, then, too, learning is very likely to be at an end.

One of the best ways to stimulate learning is to gather together a number of learners who are progressing at about the same rate. First one and then another of them will lead or fall behind the rest. Under such conditions errors result in enough bitterness to spur on the learner, but not enough to discourage him, and successes result in just enough pleasure to make him strive for more, and not enough to make him self-satisfied. Men have failed to develop their full powers because of insufficient competition and also because of competition that was too much for them. One should first make a careful judgment of his own capacity and then get into surroundings where competition will be fairly close.

A fact that we may well keep in mind in this discussion is that the unpleasant consequences of a certain type of false step will not always continue to affect learning in the same way. Men who are being trained as scientific investigators may be discouraged and almost weeping at the scathing criticism which meets their first piece of research work. If they are asked at that time whether such bitter medicine can ever act as a stimulant, they will probably all say no. But, in the course of time, many of these men learn to stand criticism and profit by it. It is not that they learn to enjoy it. It still makes them flinch. But they learn to take it in such a way that it really helps them.

The sting of criticism and partial failure is especially hard to get used to and profit by, because we are so prone to picture the learning process as smooth and comfortable. Many young and ambitious authors have the idea that good writing is largely a matter of native ability and inspiration, and that training has very little to do with the matter. When their early compositions are picked to pieces by some

critic, they feel, therefore, as if an attack had been made upon the deep and unchanging foundations of their characters. It usually takes considerable time before the literary apprentice realizes that, no matter what his native endowment, he still has much to learn and that criticism, though somewhat hard to bear, gives him definite and necessary clues to surmountable shortcomings that block his path of progress.

While much of the roaming about from job to job is due to discontent over the lack of immediate and tangible rewards, it is also due to lack of knowledge about the learning process and inability to stand the hard knocks and disappointments that are seldom absent from it. Learning means increasing one's ability. But in order to increase one's ability, things must be attempted which can at first be done only imperfectly. Such a procedure means that a certain amount of failure is a part of the business of acquiring skill. Anything like criticism, which calls particular attention to each failure, is sure to increase its sting, but it is perhaps equally sure to make the nature of the failure stand out more clearly and thus aid in its future elimination.

Repetition aids fixation. — "Practice makes perfect" is an old saw pointing out the fact that repetition is a prime factor in fixing a habit. Practice is able to fix undesirable habits as well as desirable ones, however, and before indulging in repetition it is necessary to be sure that it is really the habit we desire that is being repeated. If the beginner at tennis has more bad habits than good, continuous practice, if indulged in without advice, coaching, or thoughtful analysis on his own part of what he is doing, may easily fix his bad habits so much more firmly than the good that years of proper training will be unable to make him a skillful player. Repeated attempts to get along without tobacco are worse

than no attempts at all unless they are carried through with at least some success. If each trial is soon given up, the only habit that will be formed will be the habit of giving up.

Nothing is more necessary for learning than practice, but it is frequently necessary to employ all sorts of safeguards to be sure that in our practice we are repeating the act we wish to fix. One of the best of these safeguards is an understanding of just what we are trying to do. When we have this understanding, correct action on our part will result in the pleasure of our own approval and incorrect actions will result in the displeasure of our own disapproval. All this will lead in the end to the more and more frequent exercise of the habit we wish to fix. When a habit is so complicated that it is impossible for the beginner to tell the difference between those things essential for its successful formation and those things working against it, it is well to seek instruction so that one may be sure that those essential things will really get the greater repetition.

Repetition should not be too continuous. — But let us suppose that a person is learning tennis, that he has a good understanding of the principles of the game, and that he is constantly protected from bad habits by the advice of an expert coach. Under such circumstances it might seem that repetition could never result in anything other than increased skill; but there is still something to be guarded against. If one devotes two solid hours to the rehearsal of some one stroke, such as the service, he is likely to become fatigued. Now, when one is fatigued it is natural for him to save himself, and unconsciously he changes the nature of his movements. This is clearly observable in heavy work, like carrying a large suitcase. As fatigue sets in, the carrier changes his gait, brings his arm close to his body, bends over, and adopts other means to relieve the muscles most

fatigued. If one practices a single stroke in tennis for too long at a stretch, the same sort of thing will happen, though not quite so plainly. The nature of the stroke will change as one tries to relieve fatigued muscles. Consequently other movements than the correct one get the benefit of repetition.

In the case of intellectual habits also, too continuous practice is prone to fix undesirable habits. It is possible, with practice, to increase one's speed of reading without decreasing comprehension of what is read. But if such practice is too continuous, progress will be much retarded, if not completely checked. Reading, especially very rapid reading, for too long at a time will bring about both boredom and eye-strain; the mind and eye will begin to wander periodically away from the page, and shortly some very unfortunate reading habits will receive the benefits of repetition.

The rule, then, is: *Take plenty of practice, but spread it out enough to avoid fatigue.* It would probably be well to add that this spreading should not be such as to make the periods of practice too short or too far apart in time. If the periods of practice are too short, the learner will not have time to get well settled down to work, and if the practice periods are too far apart in time, the learner will forget between periods and thus lose some of the improvement he has already made. It is impossible to lay down any hard-and-fast rule about just what distribution of repetitions is best. The learner himself has to determine that, but he can help himself considerably in the regulation of his practice by remembering these three important facts: (1) *Practice should not be so continuous as to bring on genuine fatigue.* (2) *It should not be in such short periods that the learner has insufficient time to get settled down to work.* (3) *The practice periods should not be so far apart in time that the learner has forgotten by one period much of what he learned during the previous period.*

Absence of distraction aids fixation. — If, while practicing at tennis or rapid reading, the attention is constantly being diverted by sights, sounds, and the like that are, in themselves, foreign to tennis or reading, learning will in most cases be interfered with. One will react to these distractions as well as to ball and opponent, or to book and page, and these reactions are almost certain to be irrelevant, and, furthermore, actually disturbing to the main purpose. Still, it is not always wise to protect the learner from every distracting sight or sound. In actual life the automobile driver is called upon to exercise his skill in the noise and turmoil of the city street. When he is learning to drive, therefore, it is well if he be subjected to a certain amount of distraction in order that he may learn, not simply to drive well, but to drive well in the face of distracting sights and sounds.

There is another reason why all apparently irrelevant stimuli should not be removed from the surroundings of the learner. Certain of such stimuli, rather than interfering with the task at hand, really make the learner more alert and wide-awake. It is easier, as a rule, to study in familiar surroundings, even though those surroundings, themselves, have no pertinent bearing on what is being studied. If one is used to studying there, the familiar walls, furniture, and even the harsh noises of the street are important factors in putting one in the mood for study.

Fortunately it is seldom difficult to decide which irrelevant stimuli are likely to interfere with learning and which will have a negligible or helpful effect. The sights and sounds that sharply modify movement and trains of thought are the ones to be rid of, unless, as in the case of the automobile driver, resistance to such distractions is one of the most important elements in the skill he is to develop.

Close attention aids fixation. — Everyone knows that listlessness and inattention to the task at hand seldom produce rapid learning. Why this is so is fairly evident if we recall our conclusion that one of the best safeguards against repeating the wrong rather than the right act is an understanding of what we are trying to do and how it ought to be done. If we do not pay strict attention to our actions, errors may creep in without our knowledge and, therefore, without our having an opportunity to realize their undesirable consequences. In addition, when we are not paying attention to the act we are trying to improve, we are far more open to the influences of irrelevant stimuli (distractions) which call forth thoughts and movements of an interfering character.

Proper distribution of attention is important. — Occasionally an individual who, from most indications, is paying close attention to what he is about fails to learn as rapidly as we expect. There are golf players whose strength, agility, and intelligence should take them far, and yet they do not seem able to improve their game, no matter how much they concentrate upon it. In fact, it sometimes appears as if they do better when they are less attentive to each stroke. But their difficulty does not come from overconcentration. It comes rather from the fact that they do not concentrate on the right thing. Each stroke in golf, like each act in most other kinds of performance, contains a number of features any one of which may be the chief object of attention. The golfer, as he swings, may have chiefly in mind the ball he aims to drive, the green toward which he aims to drive it, the fact that he wants to hit hard, the position of his feet, the turn of his wrists. Or he may be wrapped up in ideas of what the results of his shot are to be. He may have his mind fixed upon the anticipation of a beautiful shot or a

dismal one. His mind may even swing back and forth between the good prospect and the bad. Now, surely no golfer can concentrate on all these things equally, and even those who are not experts realize that some features of the golfer's swing deserve more attention than others. Anyone who has paid any attention to this sport has heard, times without number, that, as the swing is actually being made, attention should be almost exclusively on the ball. "Keep your eye on the ball," or, as experts have been inclined of late to make it, "Keep your mind on the ball." This is perhaps the major axiom of the game, and yet it is just what is disregarded by those players, mentioned a few lines back, who do lots of concentrating and still fail to improve. They concentrate most probably upon "I must hit it hard" or "O! What if I should make a poor play!"

There are many of these cases where learning is handicapped, not by inattention, but by attention directed to the wrong feature of the performance. He who would improve his ability to talk in public has first to learn to concentrate upon what he wants to say. The sight of an audience is inclined to bring up hopes of success and fears of failure which crowd out every other thought. Only by learning to concentrate upon his own remarks can the speaker rise from the terrible paralysis of stage fright to free and easy eloquence. It is justifiable for a man to pay some attention to the prospects of promotion offered by his job, but a mastery of that job will be most favored if the principal object of attention is the work itself rather than its more remote results.

Not long ago a student became very much discouraged. It seems that some years previously he showed a certain amount of literary talent and that he was encouraged by his teachers to make a writer of himself. This he was trying conscientiously to do, but it seemed as if he could not make any

progress. The reason for this state of affairs, as it turned out, was not that he had lost what talent he started with, but that his attention was misdirected. Instead of concentrating on such details as getting hold of something worth writing about, studying the literary style of successful authors, and increasing the range and accuracy of his own vocabulary, he was mainly concerned with whether he actually could learn to write or not, and what success in that field of endeavor would mean to him. There was no harm in his thinking of the future, but giving it his chief attention made him neglect important details and created in him a self-consciousness which had the same disastrous effects as the self-consciousness of a public speaker who continually wonders, while he talks, what the audience is thinking of him.

Best direction for attention changes as learning progresses. — When a child is in the early stages of learning to add, it is probably best to direct a large part of his attention to the accuracy of his work. In this way he is likely to become aware of the many errors he is sure to make and, being aware of them, he will be in a better position to eliminate them. But as time goes on and his skill increases, errors will be so infrequent that there is little danger of their being fixated. When this comes about, his attention can better be directed to speeding up his work.

We have spoken of the fact that if a person, trying to acquire skill as a public speaker, does not fix his attention mainly upon what he has to say, he is likely to get along badly. Too much attention to his audience is especially likely to interfere with his progress. And yet, after the rudiments of public speaking have been mastered, further progress often depends upon directing attention to that once disconcerting audience and upon learning to modify

one's remarks according to the facial expressions one is able to observe.

Failure to acquire more than a moderate amount of skill is often brought about because of the absence of an essential shift in the direction of attention. Billiards furnish an excellent example. There are two fundamental considerations for the billiard player as he steps up to make a shot. In the first place, he must score a point and, in the second place, in doing so he must strike the balls in such a way as to bring them into a favorable position for the shot to follow. Now the game is difficult enough so that the beginner usually concentrates on making the shot immediately before him without particular regard to how he is going to leave the balls for his second shot, in case he makes the first. Even though he does neglect this second problem of what is called "gathering" the balls, his scoring power will show considerable improvement for some little time. But finally he will reach what seems to be the limit of his capacity to improve. Whether or not he goes beyond that point will depend largely upon whether he ceases to give all of his attention to the play immediately before him and begins to take into serious account the business of "gathering" for the succeeding play. If he does, he may at first be distracted and seem to lose in skill, but in the end this shift in attention will open to him possibilities for progress which would have been closed without it.

What sets the limit of our learning? — It is a striking fact that much of our learning seems to run up against a fairly definite limit, beyond which it will not go. As we have pointed out above, this failure to improve may be due to the fact that a somewhat radical change in procedure is necessary after learning has advanced beyond a certain stage. In the cases cited, this change in procedure necessary for

continued progress was essentially a change in the object of principal attention. There are also other ways in which progress that has apparently stopped may be renewed. A North American who has learned to speak Spanish reasonably well, but who has apparently reached the limit of his capacity to attain further skill in this direction, will almost immediately resume his improvement if he is thrust into a South American community where he constantly hears Spanish and where he is constantly forced to speak in that language. In tennis the casual practice furnished by an occasional friendly match will bring one's skill only up to a certain level. The ambitious player who wishes to go on improving long after he has reached a level where the average player would be content to rest is forced to go at the business in a very different way. His practice must be regular and well distributed; he must study his shortcomings and seek patiently and methodically to eliminate them; in brief, he must substitute a professional for a purely playful attitude toward the undertaking.

So complicated is the skill involved in such pursuits as novel writing, banking, railroad management, politics, and numerous others, that it is perfectly possible for a man who sets out to acquire such skill to improve throughout his whole lifetime without ever seeming to approach the limit of learning. Of course, most men working in these fields do not increase their skill indefinitely. One reason for this is the fact, described above, that to keep on learning it is frequently necessary to make changes in one's methods of work which would not occur to the average man. Therefore his progress stops while there are yet many things to be learned and many things which he would be quite capable of learning if he knew how to go about it.

Each of us has limitations set by inheritance. There are

individuals in great number who could not become wonderful painters, scientists, or acrobats, no matter how carefully their learning were regulated. But few make maximum use of their capacities. This is partly due, as we have said, to inefficient learning methods. There is a more homely fact, however, which should not be left out of account. Few people go at the acquisition of skill with anything like a full measure of persistence. And yet, has it not been said that genius, itself, is mainly a willingness to take great pains! There is reason to marvel at the native talent of the expert, but let us still remember that no inherited foundations for achievement can render unnecessary much patient and persistent practice.

Mr. Irving K. Pond, in an essay on the circus,[1] shows us how much more than knack or freak gift of nature is the art of the acrobat. Let us follow for a moment Mr. Pond's description of a particularly brilliant act by the brother performers, Ernest and Charles Clarke:

> . . . Charles is pendent, head downward, from a rhythmically swinging trapeze some yards away from and facing his brother. At a signal from Charles, Ernest, who is poised on the distant perch, attuning himself to the rhythm, grasps with both hands the bar of his trapeze, which moves through a longer arc than does that of his brother, and, with a vigorous initial movement, makes a rapid swing at the end of which he leaves his bar, makes two complete backward revolutions in the air, that is, throws a double back somersault, follows with a pirouette or full turn on a vertical axis at right angles to the axis of the somersaults, and catches, and is caught by, his brother, who returns him with a pirouette to the bar and thence to the perch or pedestal from which he started; and this without a break in the complex and synchronized rhythm of the factors in this entrancing equation of movement . . .

[1] *A Day Under the Big Top*, published by the Chicago Literary Club, 1924.

Mr. Pond immediately assures us that

. . . an act such as just described does not come all at once full blown and perfect out of a clear sky, but its final accomplishment involves travail of spirit and discipline of mind and body almost beyond belief . . .

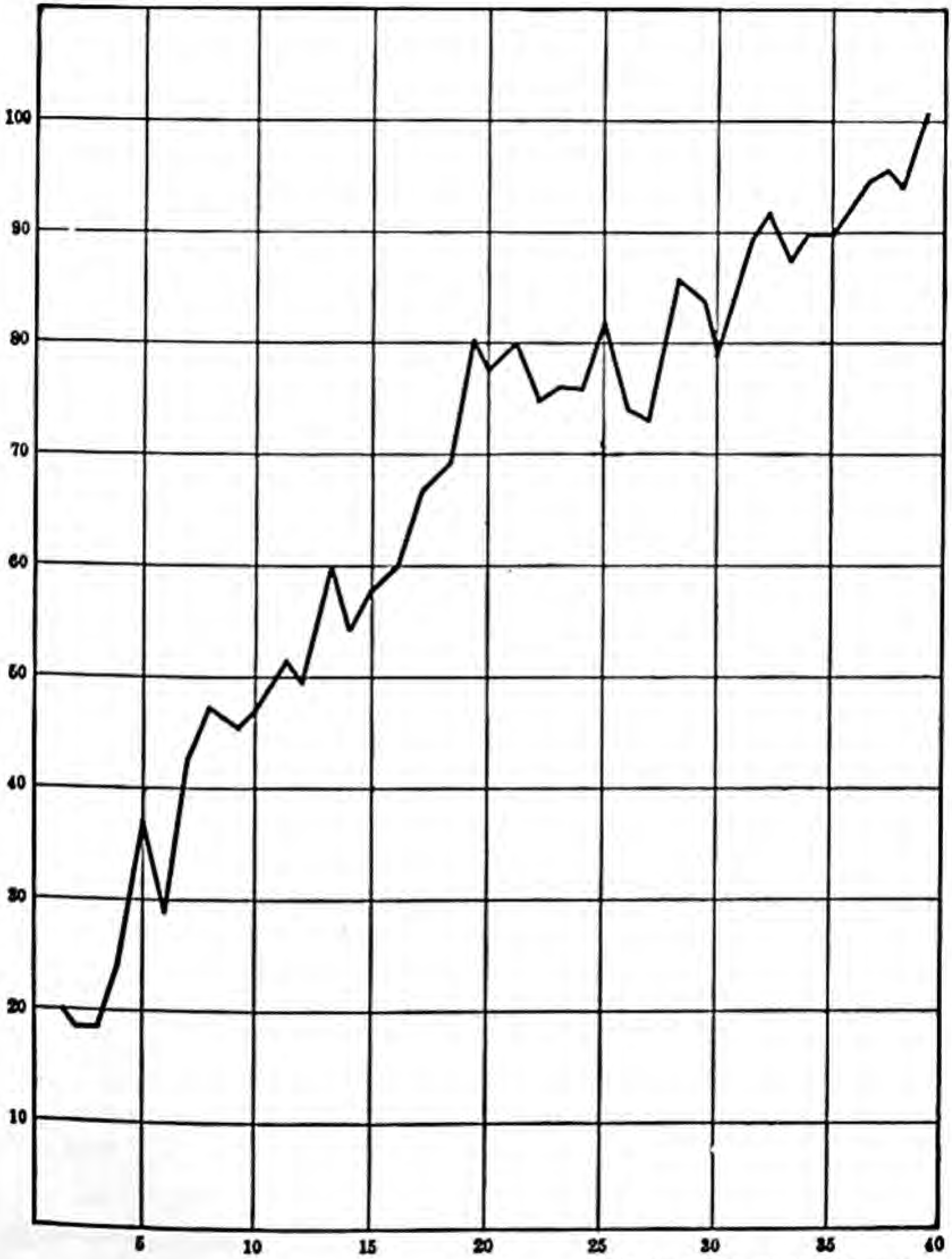
The real facts of the case are brought out in an interview with one of the performers:

. . . "Ernie," I make bold to say, . . . "you must have had a few falls into the net before you got that trick to perfection. Five hundred, say?" "Well," he answers quietly, "five hundred would hardly be a circumstance. We tried that at every rehearsal for a year, and no fewer than ten times at any rehearsal before ever our hands came together" (and every try meant a drop into the net). "Then we caught and held, and in three and one-half years more — four and a half years in all — longer than a college course — we reached the point where we thought we could be justified in letting the public see the act."

B. The Curve of Learning

Rate of learning shown by learning curve. — Some people learn rapidly and others learn more slowly. Furthermore, a person acquiring skill in typewriting or telegraphy, let us say, will learn faster on some days than on others.

These facts about the rate of learning are best demonstrated by means of so-called *learning curves*. Figure 10 is a learning curve for telegraphy and Figure 11 is a learning curve for archery. All such curves are constructed in essentially the same manner. The base line is divided so as to represent different amounts of practice, the hours, weeks, trials, shots, or what not. The vertical line is divided so as to represent different degrees of efficiency, the amount done, time required, errors made, and so on. In Figure 10 the higher points on this line represent the greater degrees of

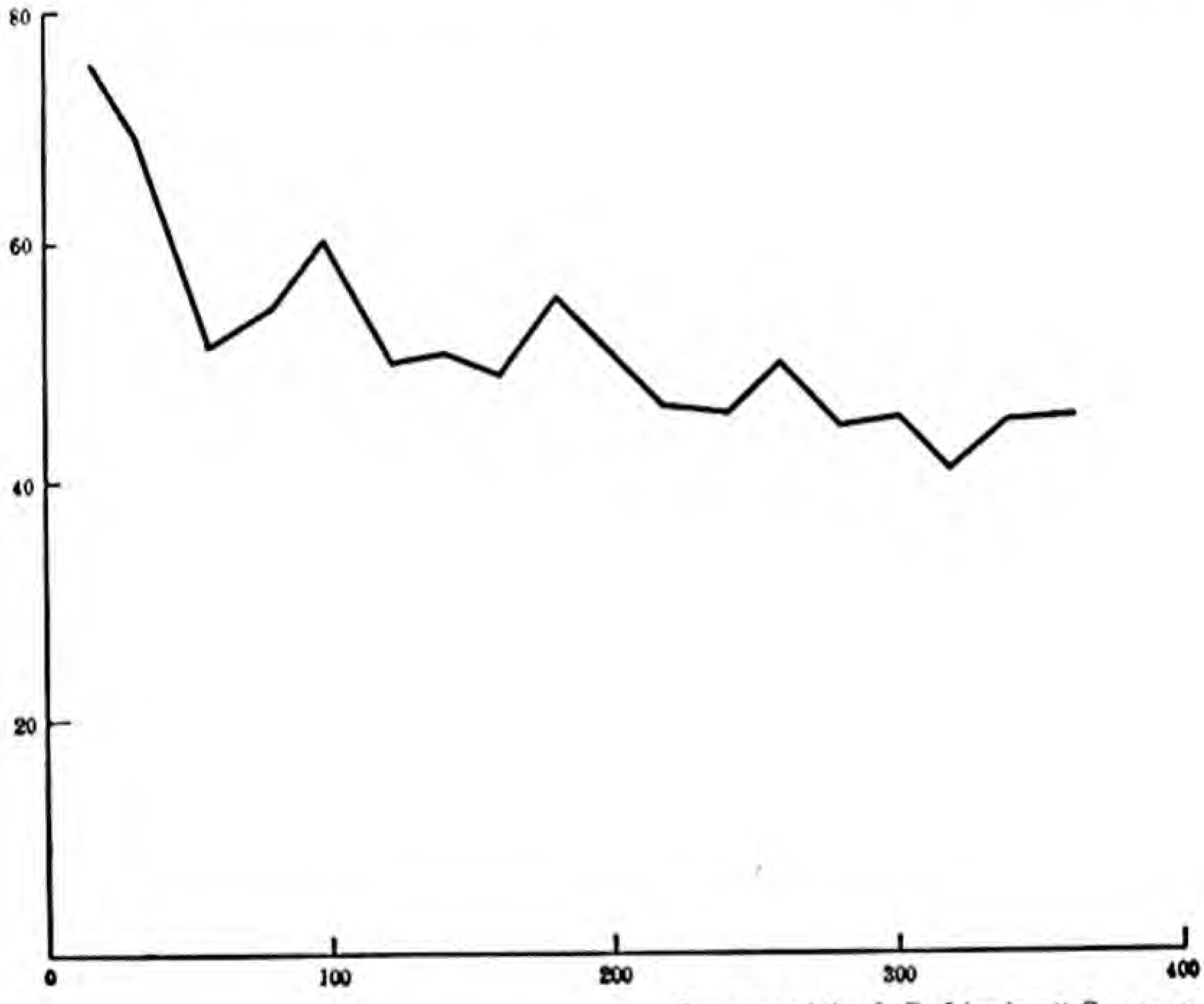


Courtesy of Psychological Bulletin

FIG. 10. — LEARNING TELEGRAPHY

The vertical axis represents the number of words the learner could telegraph in five minutes. The horizontal axis represents the number of successive days of practice. (From Swift, *Psychological Bulletin.*)

efficiency because the units are *letters written*. In Figure 11, on the other hand, the lower points on the vertical line represent the greater degrees of efficiency, because the units are *inches away from the bull's eye*. In Figure 10, then, the rising curve shows that with more and more practice there



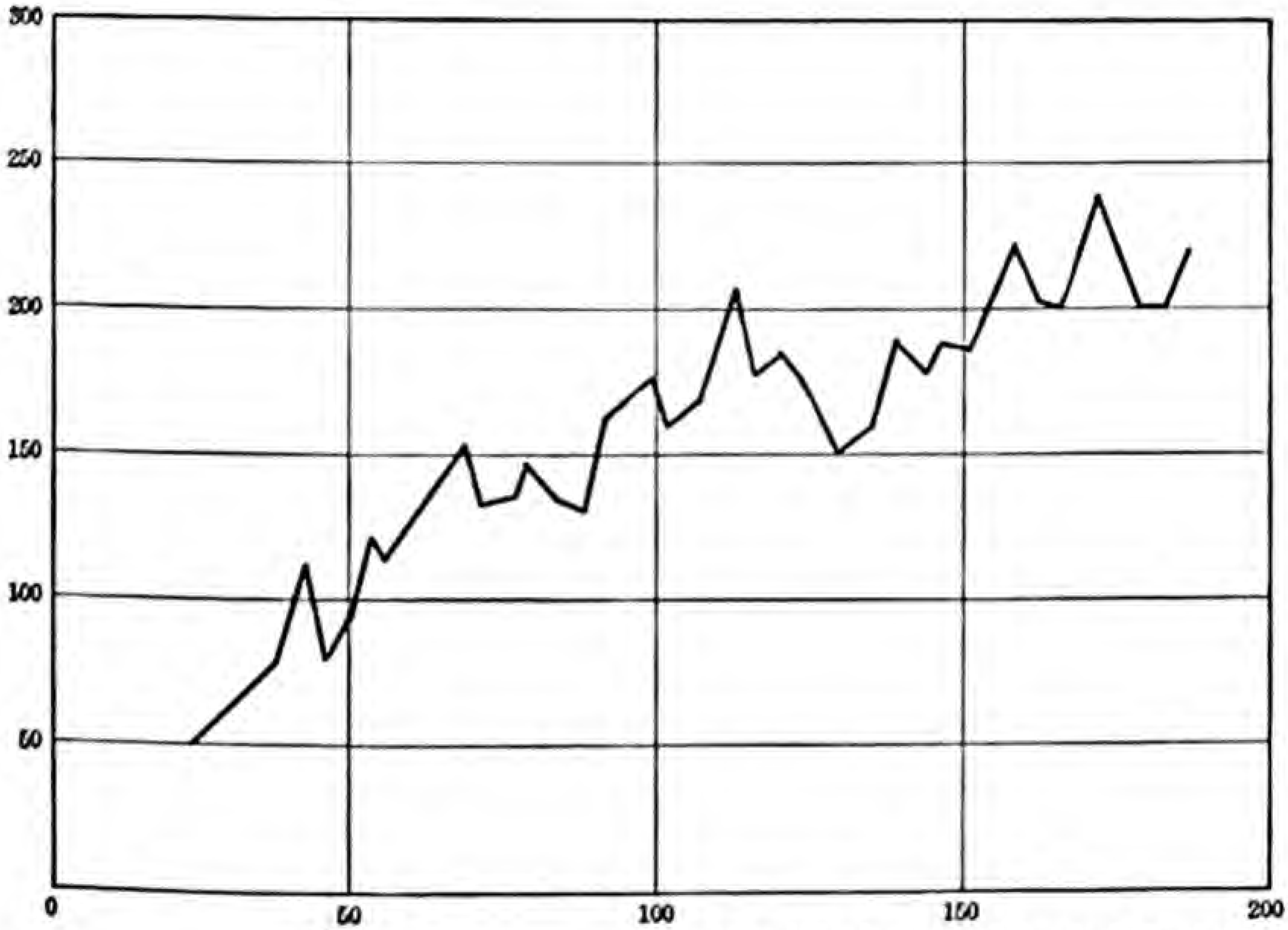
Courtesy of the J. B. Lippincott Company

FIG. 11. — LEARNING ARCHERY

The vertical axis represents the average error, or distance in inches from the bull's eye. The horizontal axis represents the number of shots the learner has had. From Watson, *Behavior*. (After Lashley.)

is an increase in the numoer of letters telegraphed in 5 minutes and, therefore, an increase in skill. In Figure 11 the falling curve shows that with more and more practice there is a decrease in the average distance of the shots from the bull's eye and, therefore, an increase in skill.

The steepness of the learning curve signifies the general rate at which the learning is progressing. In Figures 12 and 13 we have two curves showing the number of words which could be typewritten in 5 minutes, as more and more practice was given. Each curve represents the learning of one



Courtesy of the Journal of Applied Psychology

FIG. 12. — LEARNING TYPEWRITING, SUBJECT F

The vertical axis represents the score in a five-minute test of typewriting. The horizontal axis represents the number of hours of practice. (From Chapman, *Journal of Applied Psychology*, 1919.)

individual. After 20 hours of practice F and G are able to type about 50 words in 5 minutes. But while it takes F considerably more than 100 hours of practice to reach a point where he can type 200 words in 5 minutes, G attains that degree of skill after considerably less than 100 hours of practice. Notice how much more steep is the rise of G' scurve than that of F!

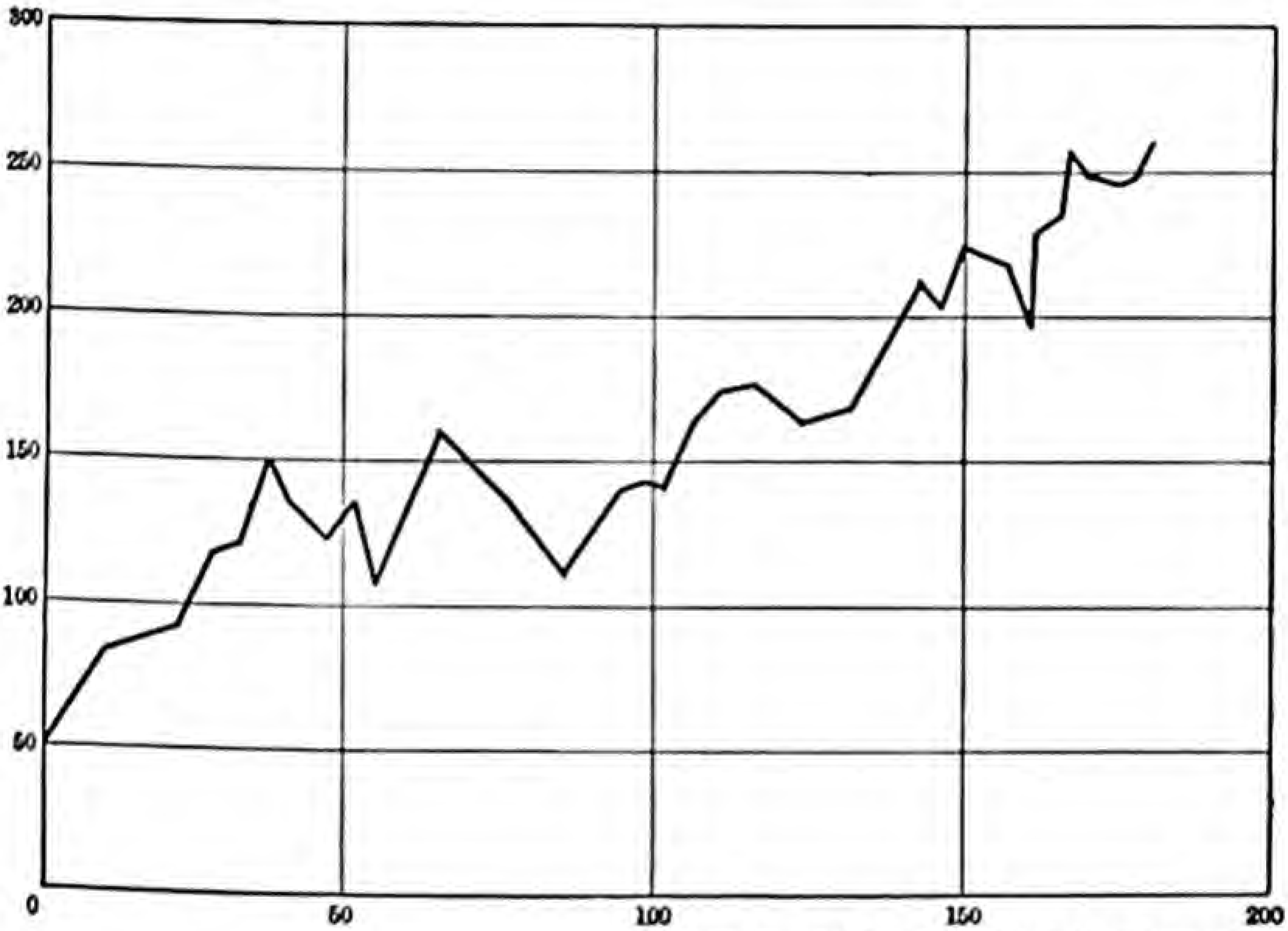
Anyone who has ever learned a foreign language or acquired some form of manual skill knows that learning does not always progress smoothly. On some days an advance seems to be made, while on others it seems more as if skill were being lost. All of the learning curves we have thus far

FIG. 13. — LEARNING TYPEWRITING, SUBJECT G

The explanation of Figure 12 applies to this figure also. (From Chapman, *Journal of Applied Psychology*, 1919.)

examined indicate that this is the actual state of affairs and not a mere impression. In general, these curves show that learning is progressing, but if examined in detail they show, by their marked irregularities, that this progress is a matter of fits and starts. There are numerous reasons why learning

should go on in this way. The facts that the learner never feels exactly the same on two successive days, and that practice cannot possibly be given at different times under identical external conditions (the weather, the street noises, and the like are bound to differ from time to time) are two very evident causes of irregularity in the progress of learning.



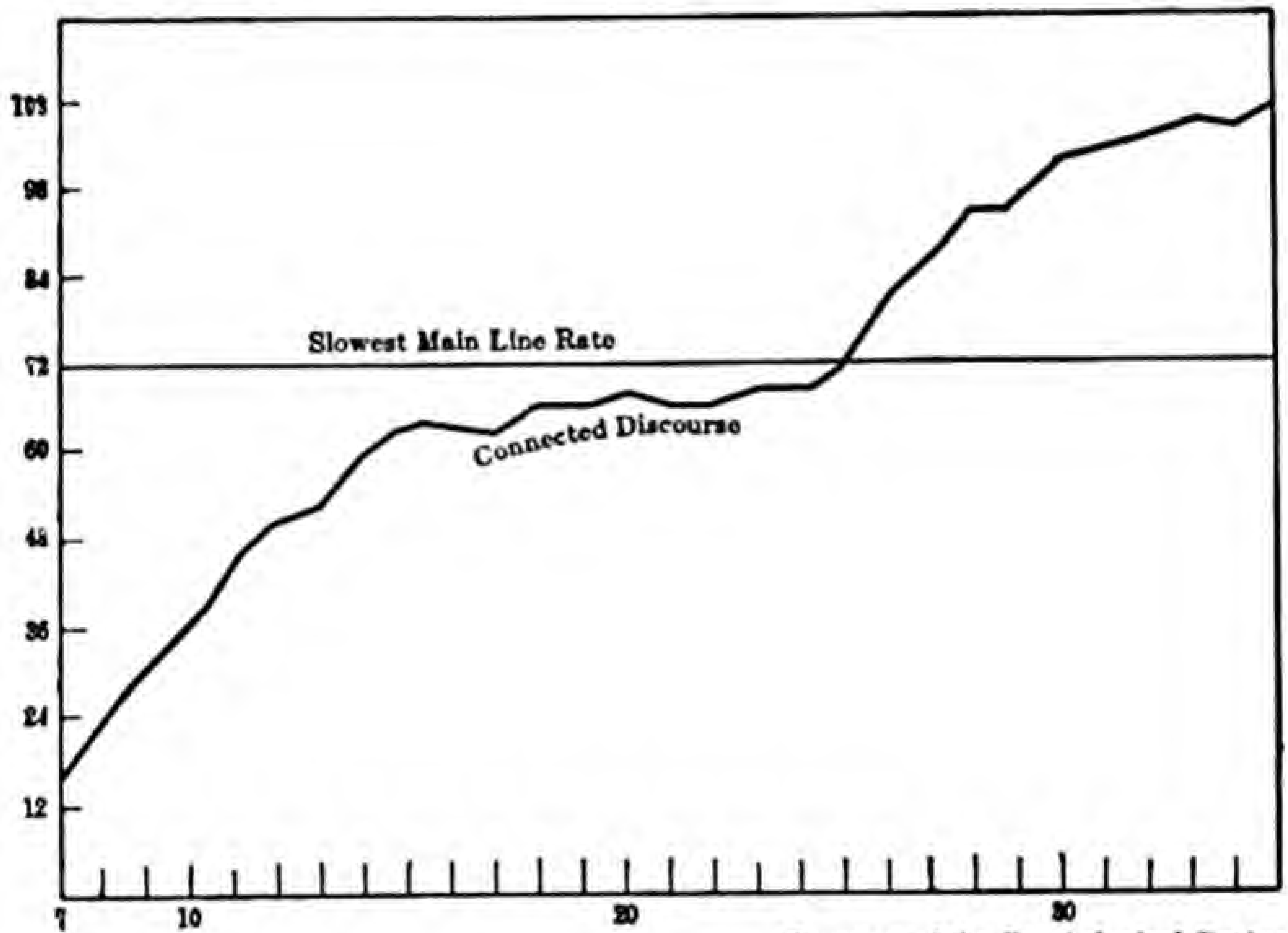
Courtesy of Journal of Applied Psychology

FIG. 14. — LEARNING TYPEWRITING, SUBJECT M

The explanation of Figure 12 applies to this figure also. (From Chapman, *Journal of Applied Psychology*, 1919.)

Besides these daily irregularities in the rate of learning, there occasionally appears a prolonged period of no progress or very slow progress. The individual whose rate of learning is represented in Figure 14 improved steadily for about 50 hours of practice. From then until he had had over 100 hours of practice no evident improvement took place. Following this period, however, improvement was resumed

at its former rate. A similar effect is shown by the curve of Figure 15, which represents the acquisition of skill in receiving telegraphic messages. Such temporary, but relatively long, periods of no progress or extremely slow progress are known as *plateaus*. We have already dwelt at some length upon the fact that learning is often seriously retarded, if not brought to a complete stop, because the learner has



Courtesy of the Psychological Review

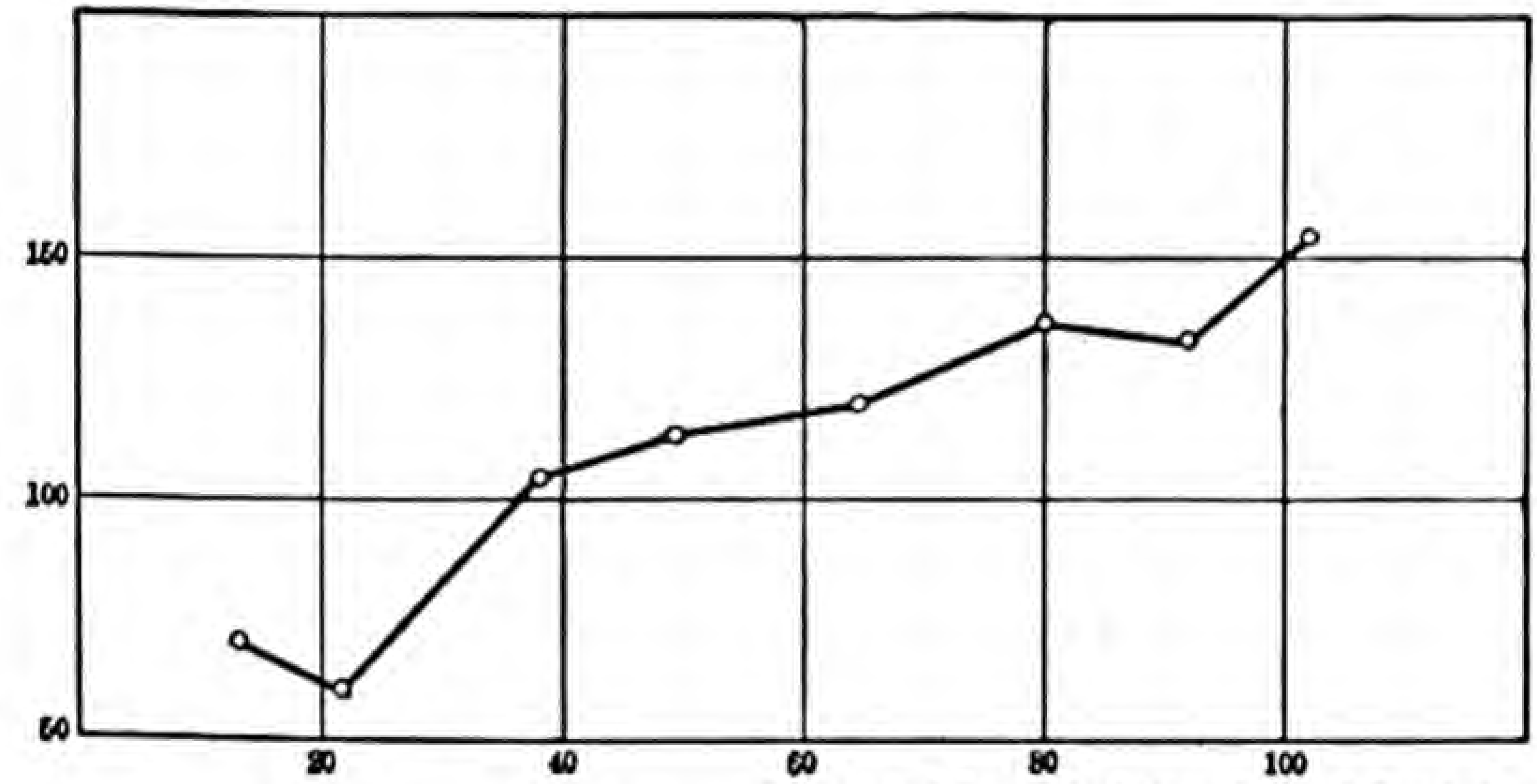
FIG. 15. — LEARNING TELEGRAPHY

The vertical axis represents the number of letters per minute in receiving connected discourse. The horizontal axis represents the number of weeks of practice. (From Byran and Harter, *Psychological Review*, 1899.)

gone as far as he can by means of the direction of attention and the methods of procedure which he has been employing. Sometimes he quickly hits upon the shift of procedure necessary for a resumption of progress. In that case no plateau appears in his learning curve. Sometimes he never discovers how to continue his improvement. In that case the learning curve simply ceases to rise or fall, as the case may be; it

shows no plateau. But there are other times when the learner, after apparently progressing as far as he can, finally, as a result of continuing his practice, hits upon an improved way of going about the task at hand. In that case progress is resumed at something like the rate it had before the temporary barrier was encountered, and the result appears in the learning curve in the form of such a plateau as those of Figures 14 and 15.

We have said that the rate of learning is shown by the slant of the curve. If the slant is gradual, learning is rela-



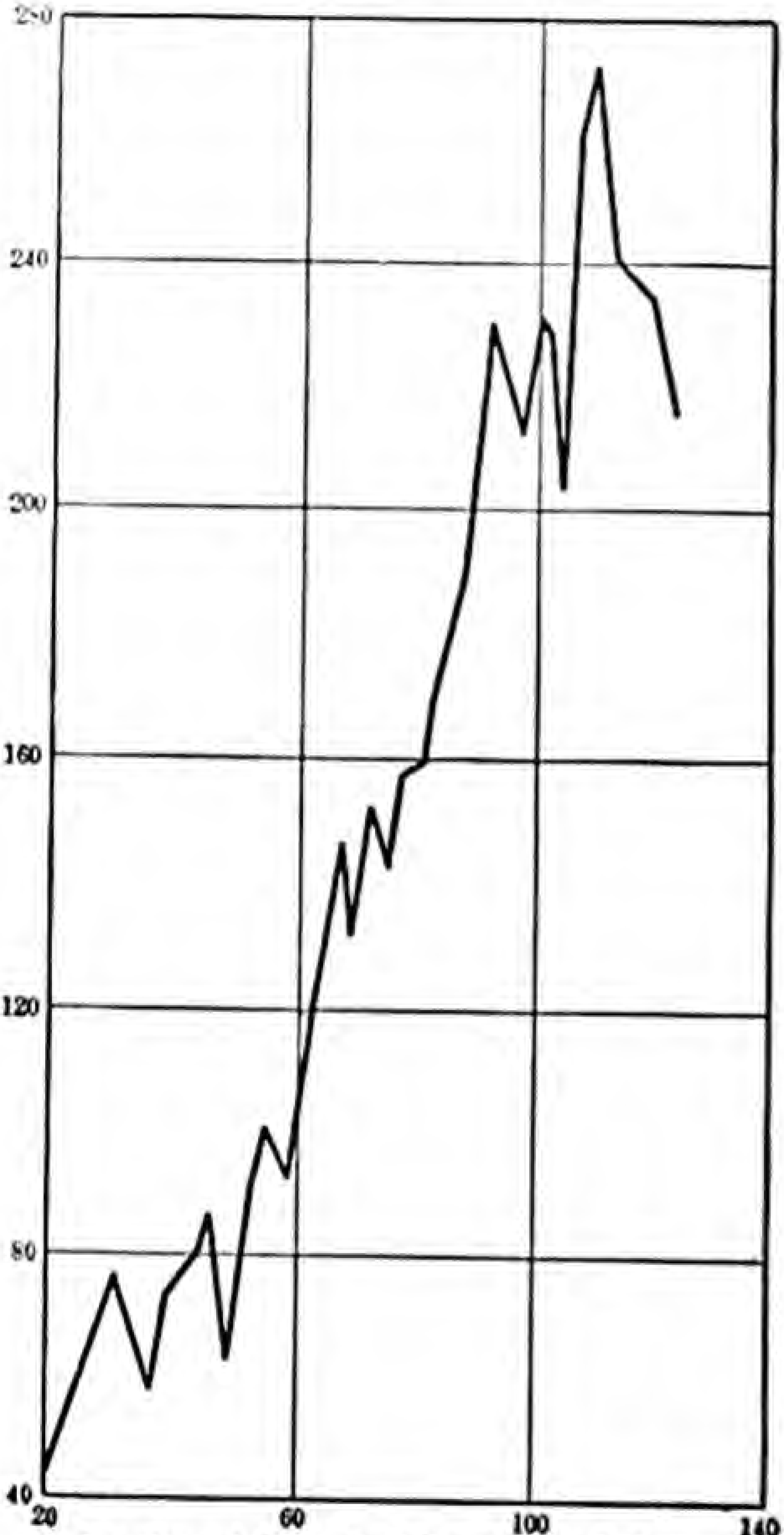
Courtesy of Journal of Experimental Psychology

FIG. 16. — LEARNING TYPESETTING

The vertical axis represents the amount of type set per hour. The horizontal axis represents the number of hours of practice. (From Kelley and Carr, *Journal of Experimental Psychology*, 1924.)

tively slow, and, if the slant is steep, learning is relatively rapid. Look again at the curves of Figures 11 and 12. You will notice that the slant of these curves becomes less and less steep as the learning goes on. This means that learning started off rapidly and gradually slowed down. This negative acceleration is one of the most prevalent characteristics of curves of learning. (Acceleration means change in rate

of speed, and negative acceleration, therefore, means slowing down.) It represents the fact that, as higher levels of skill are attained, it becomes increasingly difficult to progress.



Courtesy of Journal of Experimental Psychology

FIG. 17. — LEARNING TYPEWRITING

The vertical axis represents the score in a typewriting test. The horizontal axis represents the number of hours of practice. (From Chapman and Hills, *Journal of Experimental Psychology*, 1916.)

The rapid progress typical of the early stages of learning does not always appear at the very start. Sometimes we must have some little practice before any real progress shows itself. Figure 16 is a learning curve for typesetting. During more than 20 hours of practice, there is a loss in skill rather than a gain. Figure 17 is another curve for typewriting. The gain in skill between 20 and 60 hours is very much less than that which comes from the next 40 hours of practice. The increase in rate of learning that often occurs early in the learning process is called *initial positive acceleration.*

It is not hard to see why there should frequently be some delay before learning really gets started. When we begin practicing a new act of skill, we may have to get used to the

surroundings in which the practice is carried on. We may have previously acquired habits under other circumstances that interfere with the acquisition of skill along this new line (see page 93). Then, too, we may have to master certain general principles of the new act before we can do anything with it.

C. Features of Established Habits

Firmly fixed habits have special characteristics. — When a child first stretches out his hand and catches a ball, he is performing a habitual act, if we consider as habitual any act that is largely the product of experience. The same is true when the adding-machine operator runs off his first sum. The first stage in habit formation is devoted largely to the discovery of a fitting way of acting. We paid particular attention to that stage in Chapter IV. But before an act can become a habit in the usual sense of that term, it needs fixing or stamping in. We have been discussing in the present chapter the best conditions for hastening this fixation process and, in connection with learning curves, the rate at which fixation takes place. Now we have this additional question to raise: What happens to a habit as it becomes fixated? There are several answers to this question.

1. The very word "fixated" suggests that after practice under favorable conditions a habit is much harder to break. (*a*) He who has firmly fixed the "ball-catching" habit will still fail to make a catch now and then, but the more firmly fixed the habit, the less often will the misses occur. (*b*) Furthermore, a well-fixed habit will still work well after a prolonged period of inactivity. A man who has once learned to swim well can go for years without swimming, and yet, when he does get into the water again he will have very little to relearn.

2. If a habit serves a useful purpose, its fixation usually increases the efficiency with which that purpose is served. The learning curves told the story of the increase in efficiency of habits as practice fixated them. It should be remembered, however, that undesirable habits are just as capable of being fixated as are desirable ones. A girl who allows herself to break into tears every time things fail to go just as she would have them will soon find herself with a firmly fixed habit that interferes seriously with her efficiency. We might say, then, that the fixation of a desirable habit increases efficiency and the fixation of an undesirable habit decreases efficiency.

3. The better fixated a habit becomes, the more powerful it seems to him who possesses it. To the man who has smoked for years, his tobacco habit is usually a terribly compelling force. This is shown by two sorts of facts. In the first place, the habit asserts itself on the slightest provocation. The mere sight of another smoking is enough to make the inveterate smoker reach for a cigar or cigarette. In the second place, anything that keeps him from smoking at such customary times as after meals makes him exceedingly uncomfortable.

4. As a habit becomes more firmly fixed it requires less attention, effort, and thought. In other words, it becomes increasingly automatic. Many of the habitual facial expressions and other mannerisms which we see from day to day are so fixed that they operate without the person in whom they appear being aware of them. Walking, under most circumstances, is so well fixed that it is quite automatic. Only when we are in a crowd or faced with some other unusual situation do we pay any attention to the manner of our walking. Some other acts rarely, if ever, become well enough fixed to be completely automatic. Boxing, automobile driving, and typewriting are not apt to go on uncon-

sciously. Still, as skill in those lines is more and more highly developed, certain elements in them do become automatic. The sight of the exposed chin of his opponent calls out within the smallest fraction of a second an uppercut from the experienced boxer. The opening is there for such a short time that, unless the punch occurred automatically, it would not get home. This does not mean that the experienced boxer is unconscious of what he is doing. Just let him bid the boxing take care of itself and engage in day-dreams as he steps around the ring with a capable rival! He will not last long under such conditions. As his skill increases, the punching, ducking, blocking, and the like work without his paying any attention to his own movements, but he never reaches a point where he can take his eye and his mind off his opponent.

D. The Elimination of Habits

How habits are lost. — A story is told of a missionary who, after a number of years in China, learned to speak the Chinese language with some fluency. In the course of time he returned to his native land, and during the years immediately following, he had no opportunity to speak Chinese. And, what is more, he soon felt that his ability to converse in that language had entirely disappeared. One day the opportunity came to return to China and he accepted it. In a way he dreaded his return, for he believed that he would have to learn the language all over again. But, greatly to his surprise, as soon as he found himself in the old surroundings, with Chinese sights and sounds on every hand, he began to speak Chinese with all the skill he had formerly possessed. Many of the habits that we think are lost are no more lost than this missionary's skill in speaking Chinese. Habits and systems of habits are ways in which we learn to

react to certain stimuli. If sufficient stimuli of the right kind are lacking, the habit simply will not operate. All the missionary's speaking of Chinese had been done with the sights and sounds of China about him, and these stimuli had become indispensable for the operation of his habits of Chinese speech.

In a lesser degree we have all experienced this type of occurrence. Shortly after my arrival as a freshman at college, I was walking across the campus with some new acquaintances. Suddenly we came face to face with a man who had been a classmate of mine during the four years of high school. We stopped to talk and I prepared to introduce the old acquaintance to these other men I had so lately met. But instead of carrying out my purpose I became horror stricken, for the name of my classmate, a name that had been on my lips hundreds of times, would not come. The difficulty was due to the fact that my classmate's name had always been used in high-school surroundings, and those surroundings had been part of the stimulus required to call it forth.

In forming a habit it is well to guard against getting it too closely connected with stimuli that are not always going to be on hand when we want to use the habit. Of course it would have been difficult for the missionary to prevent his Chinese language habits from becoming connected with the customary sights and sounds of China, and it would have been difficult for me to have prevented my classmate's name from becoming connected with the scenes of high-school days. But there are many situations where undesirable connections can be prevented and where the desirability of their prevention is clear. At one time an author was accustomed to do all his writing with a soft pencil on yellow paper. So ingrained did this procedure become that he

was not able even to think satisfactorily without those particular tools before him. Since it was slow and difficult work for a typist to read and copy his penciled manuscripts, he was at some disadvantage. It would have been better if he had got used to doing his thinking at a typewriter, and better still if he could have got used to thinking while dictating, while typing, and while writing in long hand, because then he would have been able to work satisfactorily under a wide variety of conditions. The man who cannot work without a cigar in his mouth furnishes another example of what we are discussing. The reason that he needs his cigar is that he has always had it while working, and his work habits simply will not operate without this seemingly irrelevant, but to him essential, stimulus.

When a habit fails to operate because of the lack of sufficient stimuli to set it off, the habit itself is really not broken up. As soon as the right stimuli are introduced (the Chinese surroundings, for example) the habit will work as well as ever. There are other cases where habits are actually broken up so that they will not operate efficiently, even under conditions identical to the ones under which they are formed.

A motorist has described a situation which has no little importance for us. "The gear shift on my father's car and that on my own are almost opposite in arrangement. His *high* is in the same position as my *low* and his *second* is in the same position as my *reverse.* Usually I can shift gears quickly, when driving my own car, and without giving the matter a thought. But after I have visited my father and driven his car for a day or two, I am unable upon my return to shift gears with the old ease. Sometimes I try to shift my gears as his should be shifted, and at other times I seem to be blocked and unable to decide in which direction to push the shift lever. Evidently the experience with my

father's car tends to disrupt the habits I have formed of operating my own."

In the course of a lifetime many of our habits are broken up by habits subsequently formed. Now and then we hear of some old gentleman who can still repeat almost word for word an oration he learned in college and to which he has not given a thought for a long period of years. But the chances are that few, if any, orations, especially of a similar nature, had been learned in the meantime. If they had, the college oration would almost surely have been wiped out.

In general, later formed habits interfere with and break up earlier formed habits only if there is some resemblance between the two. Learning a new way of shifting gears is far more likely to destroy an old habit of gear shifting than learning a new shot at billiards would be. Learning to swim would not blot out one's ability to repeat an oration, but learning another oration might. Further, learning an oration about the great poets would be more likely to break up the ability to repeat another previously learned oration on poetry than it would a previously learned oration on the wonders of modern industry. We are often struck by the fact that many habits such as swimming and skating are never lost, no matter how long we go without putting them to use. This is partly because no other habits are formed which are sufficiently similar to swimming and skating to cause the kind of interference we have been describing.

The less thoroughly a habit is mastered, the more likely it is to be broken up by the subsequent acquisition of similar habits. If you wish to retain the ability to repeat a bit of verse which is much like other verses that you will read in the future, you will have to learn it more thoroughly than you would a verse of unusual character. It is possible for a person to retain at the same time a number of habits which

would naturally be expected to conflict with each other, but in this case the habits must be very firmly fixed.

How to break bad habits. — There are times in the lives of all of us when we discover that it is necessary or highly desirable to work a radical change in some habitual way of acting. The man who shifts from an outdoor life to the sedentary existence of the office finds that he must remodel his eating habits. He finds that to maintain his health he must eat less food and lighter food. The boy whose bragging has been tolerated by parents and early companions may discover, when he gets out into the world, that this habit is held definitely against him. The bright person who has always achieved success with little effort often moves into circles where keen competition shows him habits of laziness which he hardly realized he possessed. Under such circumstances there is a need for discarding old ways of acting. When this need arises there are a number of practical points that may well be kept in mind.

1. Breaking a habit is not simply discarding one way of acting. It is also a matter of forming a new habit. Eliminating laziness means establishing habits of industry. Eliminating bragging means establishing habits of modesty. Now the chances of successfully doing away with the old, undesirable habit depend upon how clearly one gets in mind the new habit which is to replace it. It is seldom enough to say to oneself, "I shall no longer brag," or "I shall no longer be lazy." One must define for himself just how he is going to speak of his achievements in the future and just how and when he is going to be industrious.

2. It is well to seize the earliest opportunity to put the new mode of conduct into operation. Thinking about being industrious is a necessary first step, but it is not enough. Remember that "practice makes perfect." The new habit

will not begin to be fixated until it is put into practice. It is possible to do so much thinking about not overeating that one gets into the habit of *thinking* on that subject *instead of acting.*

3. The less thought given to the old habit the better. Many people fail to break such habits as smoking, because they concentrate upon *not smoking* rather than upon their daily tasks. Thoughts of *not smoking* are almost as likely to lead one to break his resolution as are thoughts of *smoking.* The safety in such a case lies in neglecting the subject as much as possible by throwing oneself heart and soul into some kind of work or play. A change in surroundings is often a very effective way of reducing one's thoughts about the old habit.

4. The more motives that can be brought to bear upon the contemplated change in habits the better. If we would cultivate habits of industry, it is well to commit ourselves to a certain amount of work which others will thereupon expect of us, and to get into surroundings where others are hard at work and not accustomed to tolerating idlers.

5. Once embarked upon a new way of acting, it is folly, at least at first, to allow an exception to occur. This is one of the things we have most to guard against. It is so easy for us to invent excuses and to convince ourselves that this is really an exceptional occasion and, therefore, should not count as a breach of our new resolution. And yet we know that repetition fixates bad habits as readily as good, and any exception is bound to add to the strength of the habit we are trying to break down.

6. As a rule it is more effective to plunge into the new program of conduct than to let go of the old habit gradually. Tapering off only prolongs the struggle and provides opportunities for the old habit to increase its hold. The new

habit, if it is to survive, must be favored in every possible manner and repeated in complete form as often as possible.

SUMMARY OF THE CHAPTER

1. The discovery of a new way of acting is only the first step in the establishment of a habit. There remains the fixation or stamping in of that way of acting.

2. The rate at which a habit is fixated, like the discovery of a new type of action, depends upon what habits have previously been formed. When one habit makes the fixation of another more rapid, there is said to be a *positive transfer*. When one habit makes the fixation of another less rapid, there is said to be a *negative transfer*.

3. Those habits that are in line with our general interests are more quickly fixated because of that fact. An interest that will really speed up our learning seldom exists, however, until we have already learned something in that line.

4. Habits that bring satisfying results are fixated more quickly because of that fact. Some kinds of satisfaction can be more permanently relied upon to aid progress than others. For instance, satisfaction in accomplishment, itself, will aid learning of almost any kind and will make the learner independent of whether others praise him or reward him in some tangible manner.

5. Habits are more quickly fixated if they prevent unpleasant consequences. This is one reason why competition and criticism, if fair, stimulate learning. They keep us aware of mistakes and thus make it easier for us to fixate an efficient habit rather than an inefficient one.

6. Repetition is a prime factor in the fixation of habits. We must always remember, though, that repetition will fix inefficient habits as well as efficient ones. For this reason mere repetition should not be relied upon until we are sure

that the act being repeated is exactly the one which we wish to fix.

7. In order for repetition to be most effective it should not be so continuous as to cause fatigue, but it should be continuous enough to allow the learner to get well settled down to work, and it should occur often enough so that the learner does not lose what he has learned between one practice session and the next.

8. Fixation proceeds best in the absence of distracting stimuli. But if the habit is later to operate in the presence of a certain amount of distraction, then even during the learning it is well to get accustomed to such distraction. Not all irrelevant stimuli are distractions. Those to which one is accustomed may actually be aids to efficient learning.

9. Close attention to the habit being fixated is helpful for at least two reasons. It insures our repeating the correct act rather than an incorrect one, and it keeps us from being affected by distracting stimuli.

10. We cannot pay attention equally to every element in an act that we are endeavoring to learn. Fixation is often rendered difficult because the element which is attended to is not the one that really needs our attention.

11. As learning progresses it is often necessary to shift the direction of attention in order to secure the best results.

12. Learning occasionally reaches an end because the learner lacks the capacity for further improvement. More often, however, the limit of learning is set by a failure to make some essential shift in the direction of attention, a failure to change to more effective practice conditions and surroundings, or a failure to exercise sufficient persistence.

13. The learning curve gives a graphic picture of the rate at which learning progresses. The study of curves of this kind gives us the following facts: (*a*) Learning proceeds

irregularly, considerable progress often being shown at one practice period and none, or an actual loss, at the next. (*b*) Some curves show relatively long periods of no progress, called plateaus. (*c*) In general, progress is relatively rapid at first and then gradually slows down. (*d*) Occasionally there is a period of slow progress preceding the early rapid progress.

14. A habit which is thoroughly fixated has a number of well-marked characteristics. Such a habit is not easily lost; if it serves a purpose, it does so more effectively; it seems to its possessor a strong impulsive force; and it operates fairly independently of attention, effort, or thought.

15. There are two fundamental ways in which a habit can be lost. If a habit always operates under a very limited set of conditions, anything in the way of a change in our surroundings may make it impossible for the habit to function properly or, indeed, at all. The acquisition of certain kinds of new habits may also interfere with the operation of a habit previously formed.

16. When it becomes desirable to disrupt an established habit, there are a number of practical points to be kept in mind. There should be a decision as to what new habit is to replace the old one; the new habit should be given frequent repetition; the old habit should be neglected as much as possible; a strong set of motives should be lined up on the side of the new habit; there should be few, if any, exceptions to the new way of acting; and, finally, the reformation should be started without delay.

PROBLEMS

1. How far has one gone in the establishment of a habit when he has worked out the solution of a complicated problem in mathematics? How far is he likely to go in the fixation of this type of act? Explain.

2. Cite a case from your own experience where the possession of one habit aided you in fixating another. Cite a case where the possession of one habit interfered with the fixation of another.

3. Do young men who are beginning the study of medicine have, as a rule, a strong interest in the *facts* that they are going to study, or is their interest more general? Explain.

4. What is the danger in giving children money or candy every time they show signs of progress in their school work or in other useful directions?

5. What are some of the attitudes which people commonly take toward criticism of themselves? What effect do such attitudes have upon learning?

6. How would you modify the saying, "Practice makes perfect"?

7. If you were forming a habit which would later be called upon to operate when you were tired as well as when you were fresh, would you or would you not avoid fatigue while acquiring this habit? Explain your answer.

8. Would it ever be desirable to remove from the learner's surroundings all stimuli not directly related to what he is learning? Justify your answer.

9. Why is it especially important to pay attention to a habit still in the process of fixation?

10. Would it be good or bad procedure for one learning to drive a car to keep his attention constantly fixed upon *not running into anything?* Explain.

11. Describe some habit that you have acquired and show how, from time to time during its acquisition, there was a necessity for shifting the direction of your attention.

12. Consider some activity of your own, such as handwriting, which no longer is improving. Why has this improvement come to a stop?

13. On each of ten successive days a man fires 25 shots at a target. The following table shows the number of hits on the different days:

Day	1	2	3	4	5	6	7	8	9	10
Hits	2	8	9	11	10	11	11	10	15	16

Construct a learning curve on the basis of these data. What does the form of this curve tell us about the progress of the man's learning?

14. We have said that an act that serves a useful purpose generally does so more effectively if it becomes a well-fixated habit. What about an act which has harmful consequences?

15. Show how the two fundamental causes of lost habits are illustrated by the fact that much of what was learned in the schoolroom is apparently forgotten as soon as the schoolroom is left behind.

16. Suppose that you had decided to break the habit of using slang. Describe just what steps you might take to make your resolution effective.

REFERENCES FOR FURTHER STUDY

Angell, *Educational Review*, 1908, pp. 4–8; or *Readings in General Psychology*, Ch. V, Selection 7-A, p. 122 ff.

Thorndike, *The Principles of Teaching*, pp. 243–245; or *Readings*, Ch. V, Selection 7-B, p. 126 ff.

Starch, *Educational Psychology*, pp. 141–143; or *Readings*, Ch. V, Selection 5, p. 113 ff.

Stout, *Analytic Psychology* (4th ed.), Vol. 1, pp. 258–263; or *Readings*, Ch. V, Selection 8, p. 128 ff.

James, *Principles of Psychology*, Vol. 1, pp. 120–127; or *Readings*, Ch. V, Selection 9, p. 132 ff.

CHAPTER VI

THE OPERATION OF HABITS

A. The Various Meanings of Efficiency
B. The Effects of Working
C. Effects of Factors Other than Work Itself

Questions to Keep in Mind while Reading this Chapter

1. Does efficiency increase and decrease only as habits are formed or broken?

2. What are the most definite meanings of efficiency?

3. How do methods of work, surroundings of the worker, motives for working, and the physical condition of the worker affect efficiency?

Growth and decay of habits affect efficiency. — In the past three chapters we have had a good deal to say about habits and their effects upon human efficiency. We have shown how the formation and fixation of desirable habits increase efficiency and how the formation and fixation of undesirable habits decrease efficiency. We have shown also how the loss of a useful habit reduces our capacity for efficient action and how the loss of an undesirable habit may be necessary for the maintenance or increase of efficiency. We have discussed other, more detailed, influences upon efficiency, such as methods of instruction, methods of practice, and environmental conditions, but we have been concerned with these only in so far as they affect efficiency through the growth or decay of habits.

Efficiency affected by factors other than the growth and decay of habits. — There is, perhaps, no other influence

which plays such a great part in determining the efficiency of human thought and behavior as the building up and breaking down of habits. But there are other influences of an exceedingly important sort. It is to these that we shall devote the present chapter. If one is very tired, some of his habits will operate at less than their usual level of efficiency. This is plainly not a matter of ordinary habit decay, nor is it a matter of the sudden formation of bad, conflicting habits. Tiredness to quite a large extent is independent of learning and forgetting. If one suddenly discovers a strong reason for doing well, his efficiency is likely to be as suddenly increased. Still, this is hardly to be interpreted as learning or forgetting.

We shall continue to discuss habits in the present chapter, but our concern will be with their operation rather than with their growth and decay. Some of the factors that influence the operation of habits also influence the acquisition and loss of those habits. The presence of distracting stimuli, for example, is capable of affecting the formation and fixation of a habit as well as its operation after fixation. It is perfectly possible, however, to consider such influences as distractions independently of the part they play in learning and forgetting. This procedure is the one we shall follow in the present chapter.

A. The Various Meanings of Efficiency

What is efficiency? — We might have inquired some time ago about the exact meaning of the term "efficiency." But it is as well to have waited until this point because we are now approaching questions the treatment of which hinges largely upon what is meant by efficient and by inefficient action.

One element in efficiency is the accuracy or quality of the work produced. In many cases accuracy or quality is of

far greater consequence than anything else. No one cares too greatly how long Shakespeare took to write *Hamlet*. Certainly, if he had taken twice as long as he did to write the play, no one would think of him as much less efficient. Nor is anyone primarily concerned with the effort which Shakespeare put upon this play. The one thing of real importance is the quality of the famous playwright's work on this occasion. Compared to this issue of quality, other issues are relatively insignificant. Numerous instances could be cited from the performances of ordinary individuals to illustrate how accuracy or quality of achievement is often of predominant importance. Now and again each of us is called upon to make some decision which is likely to affect his whole subsequent life. It may be a decision about marriage, about a job, or about a place of residence. Action in such cases is not usually evaluated in terms of speed or in terms of the effort which goes into it. The crucial question pertains to the accuracy or correctness of the decision.

While there are instances in which quality of work is very much more important than speed, unquestionably speed is another element in efficiency. Furthermore, there are many types of performance where speed is the major factor. The athlete may run gracefully or awkwardly, but the real question is, "How fast does he run?" If the coach should pay any attention to the athlete's form, it is not because of a direct interest in graceful running. Form, which in the case of the runner is equivalent to accuracy or quality, is important only in so far as it becomes expressed in speed. To the athlete, the soldier, or the man of business, there come times when delay means disaster and where almost any quick action is more desirable than the most accurate action that is slow.

Efficiency is not always either speed or accuracy alone.

Work is often evaluated according to some combination of these two. The tennis player must make his return quickly or not at all. He must also make it accurately, because a quickly executed shot into the net or over the back line will gain him nothing. The rapid addition of a column of figures can scarcely be called efficient, if the result be badly in error. But neither will the arrival at the correct sum be considered efficient calculation if an extraordinary amount of time be consumed in the process.

Occasionally still another standpoint is adopted in deciding the efficiency of a given performance. We may ask ourselves not only how quickly and how accurately the work is done, but also how much effort is expended upon it. One man may lay as many bricks in an hour as a fellow-craftsman. He may also lay them as well. If, however, he uses more muscular energy, if he tires himself out more than his co-worker, his work will not be called so efficient. Although this matter of effort expended is harder to determine than accuracy or speed, it is nevertheless of much importance.

Do accuracy, speed, and lack of effort merely represent efficiency? — Sometimes we gauge efficiency by speed, sometimes by accuracy, sometimes by a combination of the two, and sometimes by the ease with which the work is done. Now, the question arises as to whether these merely represent a *real* efficiency which lies behind them or whether they, themselves, actually constitute efficiency. The answer is simple. The accuracy, speed, and ease with which work is done are what we definitely know about efficiency. They are not, therefore, to be considered mere signs of efficiency. They *are*, themselves, kinds of efficiency.

This point is unlikely to cause argument so long as we are dealing with types of work which are generally judged in

terms of some one of the factors just mentioned. The efficiency of the poet is almost solely the quality of his poetry, and the efficiency of the runner is almost solely his speed. But where work requires consideration of its accuracy and its speed together, or even these two plus the effort involved, the case is not quite so simple. Think of performance on a school examination. Which should be given more weight, the accuracy, the speed, or the ease with which the examination questions are answered? One person will say accuracy is most important, another will say the same of speed, and still another of the ease of the performance.

In the presence of such differences of opinion we should do well to ask each debater why he considers one of these factors more important than the others. The answers would almost surely reveal that back in his mind each one of them possessed a hazy notion of an efficiency that is not accuracy, speed, or ease of work, but rather something to which a proper combination of these would correspond. But our dealings with efficiency cannot, of course, be aided by *hazy* notions. We know with some definiteness what is meant by accuracy, speed, and effort, and it is to these notions that we must pin our faith. If a given type of work demands the consideration of all three of these factors, we shall be nearer the truth to speak, not simply of the efficiency of that work, but of its three kinds of efficiency.

Where more than one kind of efficiency is important, it may be inconvenient to deal with all of them separately. In an arithmetical test we may treat a problem which is not solved correctly because of a student's lack of speed in the same way that we treat a problem not solved correctly because of carelessness. Thus a grade of 80 per cent is an expression partly of speed and partly of accuracy. Such a

procedure has a certain justification in its convenience, but a really adequate knowledge of the student's work in arithmetic would demand more than this single grade. It would demand that separate account be taken of the various efficiencies which are important in arithmetical work.

Accuracy, speed, and effort have different meanings for different kinds of work. — While accuracy, speed, and ease of performance are, themselves, kinds of efficiency, they do not always mean exactly the same thing. The term accuracy may refer to the orator's selection of just the right word to convey his meaning, to the archer's shot next the bull's eye, or to the musician's detection of a very slight difference in pitch between two tones. Speed, likewise, is an affair of various meanings. The sprinter's speed in the one-hundred-yard dash is dependent upon a type of muscular capacity quite different from that upon which depends the distance runner's speed in the two-mile event. The speed of the stenographer in recording dictation has little in common with the speed of the wit with his repartee. Effort has even a wider variety of specific meanings, perhaps, than either accuracy or speed. The difference is very great between the effort required to lift a forty-pound box and that required to keep awake when bored by an opera or a speech.

In the final analysis, then, there are many more than three kinds of efficiency. The term accuracy, if we use it without specifying just what type of work we have in mind, stands more for a class of efficiencies than for one particular kind. In this class are included the efficiency of the orator in choosing words, the efficiency of the archer in hitting the bull's eye, the efficiency of the musician in discriminating between tones, and a host of other special varieties of efficiency which for one reason or another we see fit to speak of as accuracy. In the same way speed and effort, when con-

sidered in general, are classes of efficiencies rather than efficiencies of special kinds.

B. The Effects of Working

Work curve shows effects of continuous work. — If one works continuously and without rest upon a certain task,

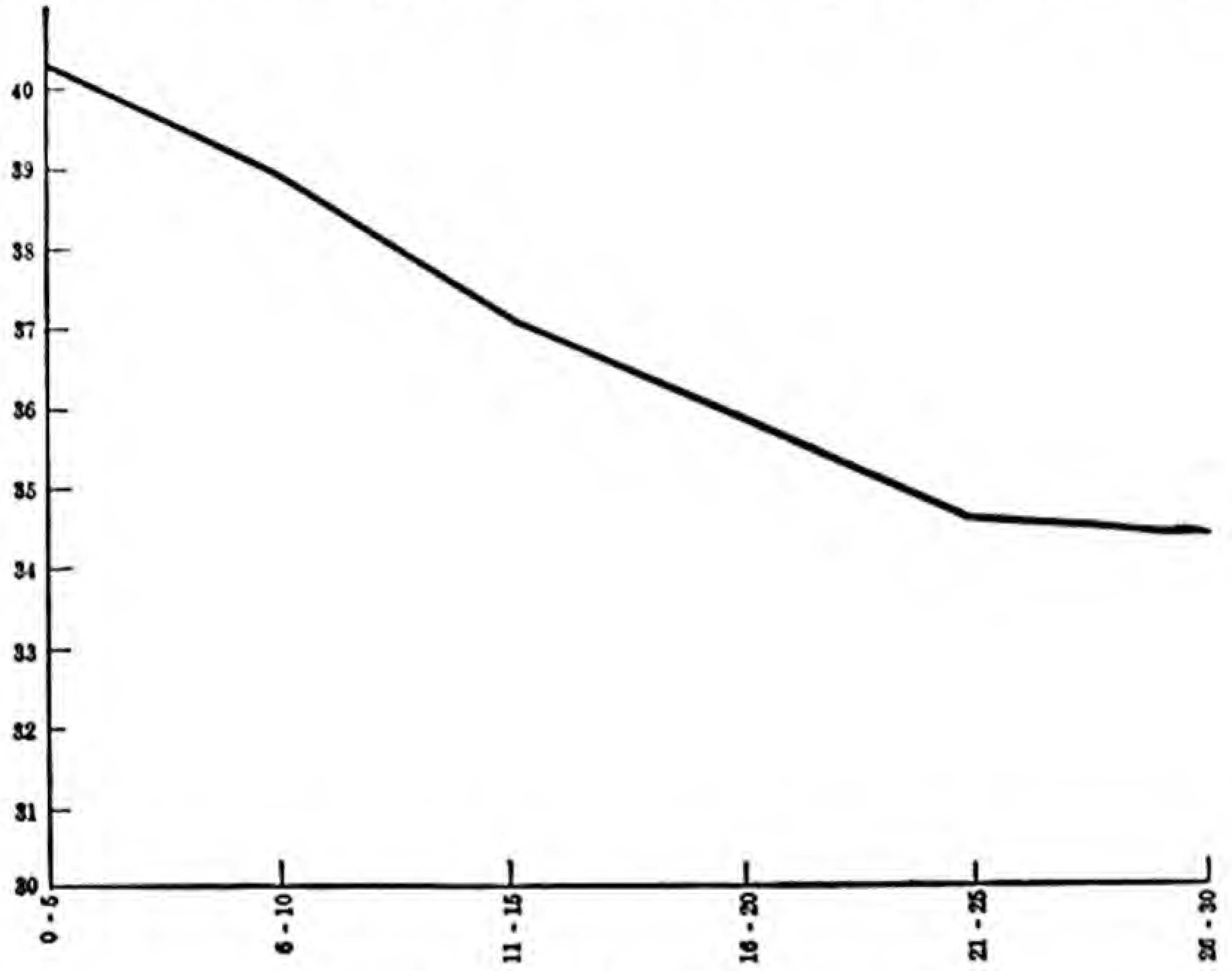


Fig. 18. — Work Curve for Tapping

The vertical axis represents the average number of taps in 5 seconds. The horizontal axis represents the successive 5-second periods of tapping. (Drawn from data of Wells, *American Journal of Psychology*, 1908.)

that fact will affect efficiency. The changes in efficiency which take place during continuous work are best shown by a type of graphic figure known as *the work curve*. Figures 18 and 19 are curves of this kind. The first represents the changes that occur in a subject's rate of continuous tapping on a telegraph key during a thirty-second period. The

number of taps made in each successive five seconds was recorded electrically. The change in efficiency shown by this curve is just what we should expect from our everyday experience. The longer the subject keeps up his tapping, the less able he is to tap with great rapidity. Such a loss in efficiency resulting from continuous work is spoken of as a *general decrement* or *work decrement.* The second curve represents what happened to the efficiency of a subject who

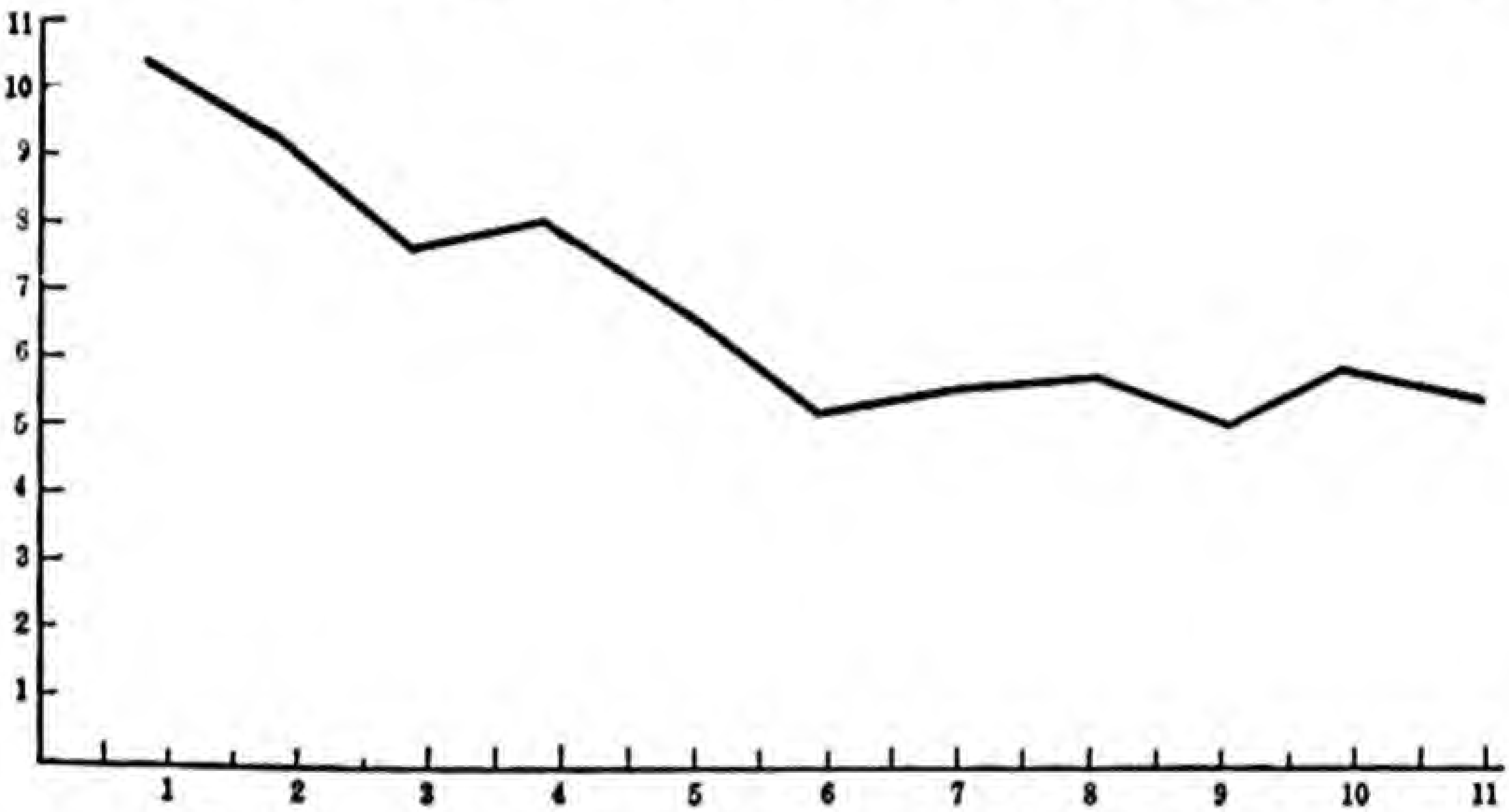


FIG. 19. — WORK CURVE FOR MENTAL MULTIPLICATION

The vertical axis represents the number of 4-place by 4-place examples worked per hour of working time. The horizontal axis represents the successive hours of work from 11 A.M. until 11 P.M. (Drawn from data of Arai, *Columbia Contributions to Education*, No. 54.)

performed mentally four-place by four-place multiplications continuously for a period of about twelve hours. Here again the most general change is a loss in efficiency, shown by a decrease in the problems solved in each unit of time, as the work continued.

General decrement the most constant feature of curves of work. — If we should examine a large number of curves of work, we should find such a general decrement, or gradual loss in efficiency, as appears in the above curves to be quite the usual thing. Occasionally even relatively continuous

work is of such a nature that the subject has an opportunity to recover from "fatigue," even while working. In this case the work might go on for a long time without showing a loss in efficiency. The beating of the heart is one activity which continues for years without showing anything like a general decrement. But the fact remains that most forms of work, if continued for a long time without interruption, do show a decrement.

Decrement depends upon continuity of work. — Since the general decrement is characteristic of curves representing

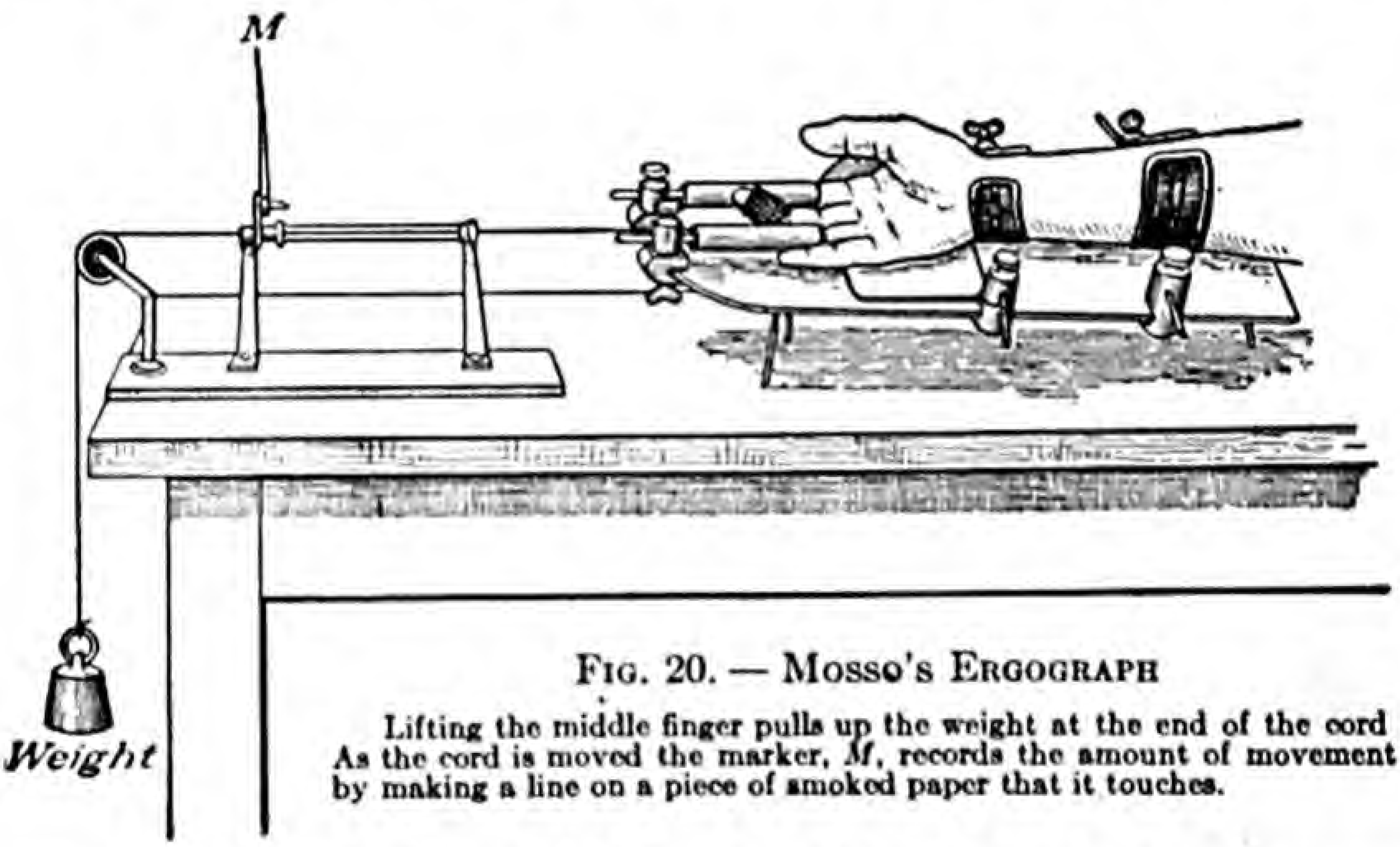


Fig. 20. — Mosso's Ergograph

Lifting the middle finger pulls up the weight at the end of the cord As the cord is moved the marker, M, records the amount of movement by making a line on a piece of smoked paper that it touches.

continuous work, it stands to reason that the more continuous the work, *i.e.*, the less chance there is for rest, the more marked the decrement should be. And conversely, the less continuous the work, the less marked the decrement should be. That we are assuming this to be the case is evident from the fact that in our last paragraph we accounted for the absence of a decrement from some kinds of work by saying that that work must permit a certain amount of resting, even while the work seems to be going on. This relationship

between the continuity of work and the decrement is, however, considerably more than an assumption based upon casual observation. There is a well-known experiment performed by means of an apparatus called the ergograph (Fig. 20). The subject is required to lift a weight with one finger in a manner shown by the accompanying illustration. The lifts are made periodically at the beat of a metronome. Now with a fairly heavy weight, a subject who is required to perform the lifts at very frequent intervals — intervals allowing scarcely any time for recovery — will show a marked decrement in the height to which he can lift the weight. Indeed, he will shortly be unable to lift the weight at all. But lengthen the intervals between the lifts, and the same subject will show a much less marked decrement. With intervals of sufficient length, the subject will be able to lift the weight to its maximum height for an astonishing period of time.

The practical bearing of this whole matter has been demonstrated in industry on any number of occasions. The establishment of regular rest periods throughout the working day often decreases the general decrement to a notable degree. Of course, these rest periods make the total working day shorter, but by virtue of their tendency to eliminate or minimize the decrement, the introduction of the rests may make the shorter day more productive than the longer one. One manager had workmen who were producing sixteen pieces an hour. He arranged a rest of five minutes every twenty-five minutes. As a consequence they produced eighteen pieces an hour, although the actual working hour was now only fifty minutes in length. Another manager more than doubled the number of rivets which his workers drove by putting in rest periods of two minutes duration every ten rivets. This result was achieved despite the fact

that the actual working time was cut from ten hours to five hours and twenty minutes a day.

Without being clearly conscious of it, the ordinary worker protects himself against too marked a decrement by adopting rest periods of more or less regularity. These periods may be so short as to be unnoticeable. They may consist merely in an intermittent slowing-down which allows for a considerable amount of recovery from "fatigue," without introducing apparent breaks into the continuity of the work.

Decrement often more marked where work is simple. — In the ergograph experiment the work performed is relatively simple. The finger to which the weight is attached is flexed over and over again at a fixed rate. Most of the tasks at which one works continuously for any length of time are much more complex. The baseball pitcher throws ball after ball, but there is variety in the manner of his throwing. In no two consecutive pitches does he employ exactly the same muscles in exactly the same way. To a limited extent there is variety in ergographic work, but that in pitching is more marked. When we consider the higher forms of intellectual work, we find even greater variety. A business man may dictate letters for three hours at a stretch, and yet there may be little repetition in that work.

Now, when work is so complex that there is little repetition involved in it, we have what really amounts to discontinuity. The work of the pitcher or of the dictator of letters is continuous in the sense that the pitching or dictating is continuous. But it is relatively discontinuous from the standpoint of the individual movements and the ideas which make up the complex activity. Since work which is continuous shows, as a rule, a more marked decrement than work which is less continuous, and since complex work involves the less con-

tinuous operation of the simpler acts composing it, we should naturally expect a less marked decrement in complex work. In order to demonstrate this relationship, we should have to compare the decrements in a number of kinds of work which are alike save for the matter of simplicity or complexity. This situation has been attained by a laboratory experiment. The subjects in this experiment performed one of two kinds of work continuously for a ten-

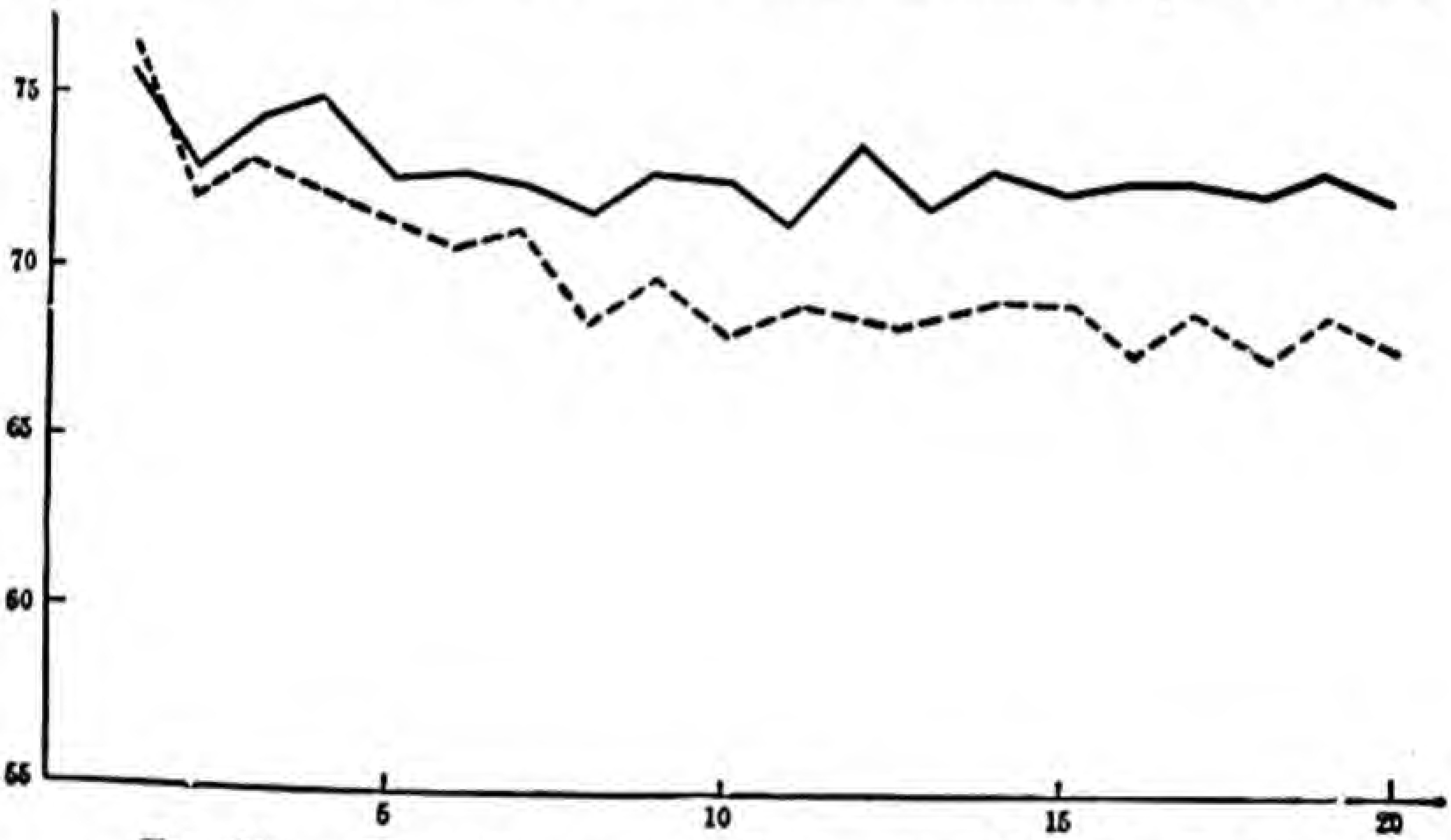


FIG. 21. — WORK CURVES FOR SIMPLE AND COMPLEX TASKS

The broken line represents the writing of a two-letter sequence. The unbroken line represents the writing of a six-letter sequence. The vertical axis shows the number of letters written per one-half minute. The horizontal axis shows the successive half-minute periods of work.

minute period. They wrote repeatedly a two-letter sequence such as *ab ab ab ab*, or a six-letter sequence, such as *abcdef abcdef*. In Figure 21 are exhibited the work curves for the two tasks. The base line is divided into twenty parts to represent the successive half-minutes of the work. The height of the curve at each point shows the number of letters written during each half-minute period. Although, at the beginning, they were able to perform at the simpler task, *i.e.*, at the task involving only two elements, as rapidly as at the

more complex task, a much more marked decrement can be seen where the work was simpler.

Decrement depends upon the kind of efficiency that is being measured. — Continuous work has different effects upon different kinds of efficiency. Professor Thorndike conducted two experiments which illustrate this fact. In one case he had eighty-nine university students write poetry continuously for about four hours. The work consisted specifically of completing one hundred and eight couplets, the first lines of which are given. The following lines are samples of those used in the experiment:

Glittering with ice here hoary hills are seen

. . . .

The fourth day rolled along and with the night

. . . .

The couplets were divided into nine consecutive sets of twelve each. The quality of the sets was rated by several judges. The speed with which each set was completed was recorded. And each subject, as he completed a set of twelve couplets, estimated the enjoyment or satisfyingness of the work. The results show that so far as speed was concerned, efficiency improved during the four hours of writing. The quality of the work remained unchanged. But there was a decided falling off in satisfyingness. In a second experiment, twenty-nine people worked at grading compositions for approximately two hours. During this period of continuous work the subjects lost much more in enjoyment obtained from the work than in speed or accuracy with which the work was done.

In most cases of continuous work, enjoyment is the first thing to show a loss, quality or accuracy is next, and speed is least affected. There are exceptions, however. The existence of a great interest may make possible the enjoy-

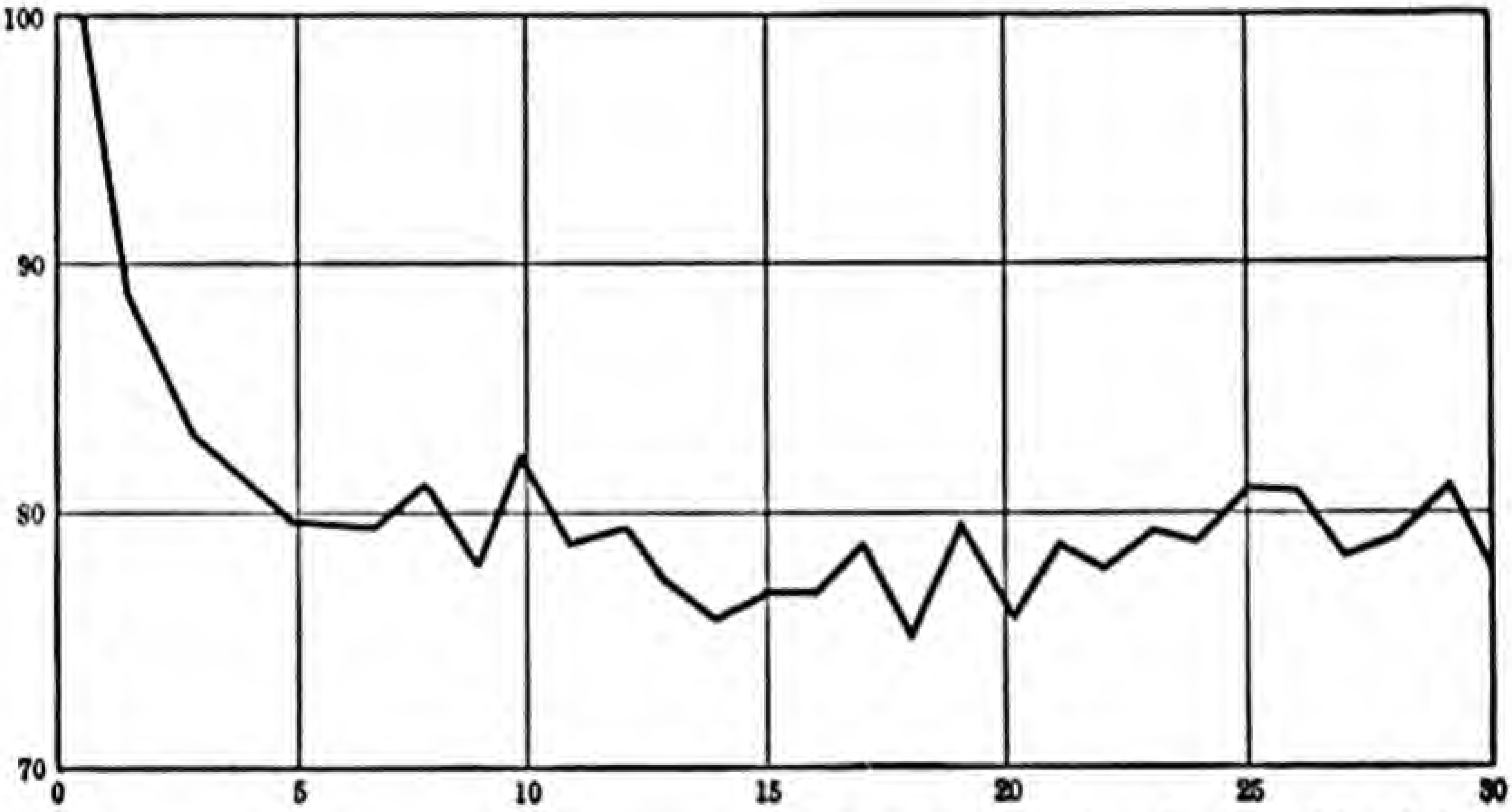
ment of work connected with that interest long after speed and accuracy have shown serious impairment.

Causes of decrement in work curve only partly understood. — All work, even that which we call intellectual, involves the activity of muscles and nerves. When any type of bodily tissue is active, a certain amount of energy available in that tissue is used up. If the activity is such that no opportunity is afforded for rebuilding the energy supplies that are dissipated during work, the capacity of the particular tissues concerned will, of course, be reduced. Undoubtedly the general decrement, as seen in some kinds of work, is partly to be explained in terms of this consumption of energy with its consequent lowering of working capacity. When the energy of muscles or nerves is utilized in work, there are produced certain chemical substances called "fatigue products." These products have a poisonous effect upon the tissues in which they are produced, and interfere with the proper activity of those tissues. This is a second factor which probably enters into most general decrements. A third factor is the discomfort which continuous work brings about. It is possible to make a subject who is hypnotized believe that he has no muscular pain, even though he has been performing a difficult muscular task. Under these conditions he will often continue with a task such as supporting a heavy weight long after the time when he would have given up if he had been aware of his "feelings of fatigue." It is common knowledge that an athlete, spurred on by the excitement of the contest, may ignore aches and pains which, under less distracting conditions, would interfere with his activity or put it to a complete stop.

We began this section by saying that the causes of the general decrement are imperfectly understood, and then we proceeded to give three definite and important causes of this

phenomenon. The limitations of our knowledge in this direction are clearly evident, however, when we attempt to tell just what part each of these causes plays in some specific decrement. The decrement shown in the ergograph experiment may be partly a matter of energy depletion. It may also involve the effects of "fatigue products" and of muscular pain. Yet we are unable to say how important these different factors are. We are still less able to state the relative importance of these factors in decrements which occur in such complex activities as mental multiplication.

Initial spurt occasionally shown by work curves.—Although the general decrement is the most frequent feature



Courtesy of American Journal of Psychology

FIG. 22. — WORK CURVE FOR ADDITION

The vertical axis represents the score on addition test. The horizontal axis represents the successive half minutes of work. (From Chapman and Nolan, *American Journal of Psychology*, 1916.)

shown by the curve of work, there are other features frequent enough to be given special consideration. One of these is *initial spurt*. This may be defined as a high degree of efficiency present for a short time at the beginning of a period of continuous work. It is a degree of efficiency which for

some reason the worker cannot maintain. The curve of Figure 22 shows such an effect in arithmetical work. The subjects of this experiment began with scores which they were able to maintain for only a few moments. After this initial spurt they dropped to a lower level of attainment which fell off very gradually.

Curves showing initial spurt and curves showing a general decrement are both marked by a drop. The difference between them lies in the fact that the initial spurt is represented by a sudden drop at the beginning of the work, while the general decrement is represented by a more gradual drop, such as those seen in the curves of Figure 18 and Figure 19. It would be perfectly possible to have a work curve showing both initial spurt and general decrement. In that case the curve would start at a high point and then drop rather suddenly to a lower level. After that there would be a more gradual falling off which would represent the general decrement.

There are two explanations of initial spurt which are worthy of note. According to one of these, the worker tends at the beginning to overestimate his capacity. He soon realizes that he will quickly dissipate his energy if he does not lessen his effort. This he does and, as a result, his curve shows its early drop. According to another explanation, the worker at the beginning is fresh and his mind is free from anything which would tend to be confusing in the performance of his task. After a few moments, however, confusions begin to occur which have a decided effect upon his efficiency. It is easy to see how this might be true in arithmetical work. After having done one or two problems, it is as if the mind were full of numbers which get in each other's way. Of course, this is only a figurative way of stating the matter, but something like this often does take place.

Warming-up is another feature of some curves of work.— What is known as the *warming-up effect* is shown by a rise in the work curve. This rise occurs early in the work, though of course, if initial spurt were also present, the rise would not be apparent at the very beginning. In Figure 23 we have a work curve representing the continuous recitation of the alphabet backward for a period of twenty minutes by

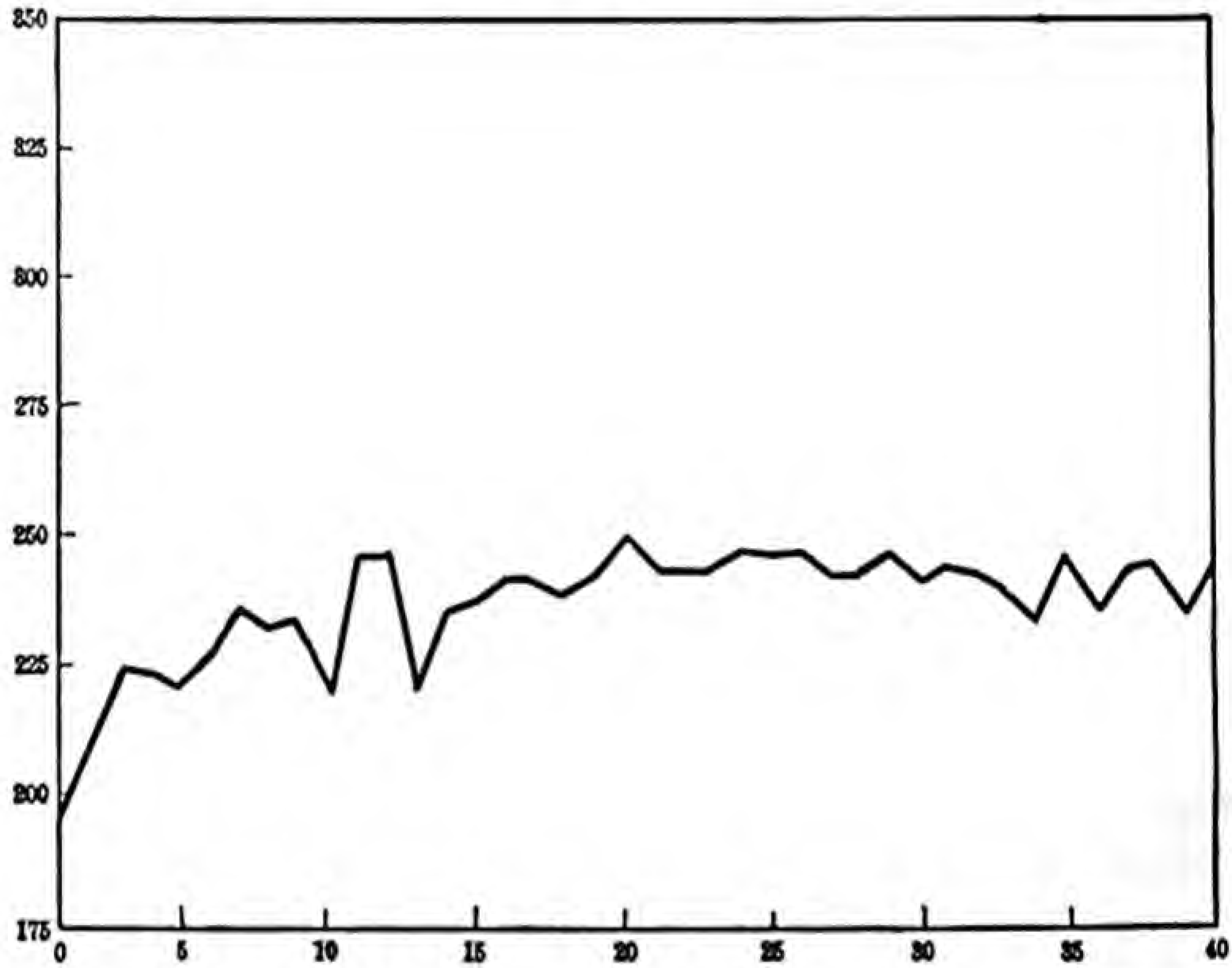


FIG. 23. — WORK CURVE FOR BACKWARD RECITATION OF THE ALPHABET

The vertical axis represents the number of letters recited in 30 seconds. The horizontal axis represents the successive 30-second periods of work. These values represent the averages for four subjects. (Adapted from Robinson and Heron, *Journal of Experimental Psychology*, 1924.)

a practiced subject. This curve shows neither initial spurt nor general decrement, but it most clearly does show warming-up.

When one enters upon a given task for the first time on that day, his muscles are likely to be stiff, and even the intellectual activities concerned are likely to have a certain

sluggishness. But after the work has been under way for a time, these handicaps are overcome.

Some psychologists have questioned the importance of the warming-up effect, because work curves obtained from experimental investigations have in many cases failed to manifest this feature. This simply shows, however, that not all types of work and perhaps not all workers require this short period of adaptation every time a certain task is undertaken. There are other work curves which show the warming-up effect as plainly as does our Figure 23. And in the practical affairs of life this effect is assumed to be of very general occurrence. Of course, we must admit that few, if any, accurate tests have been made to ascertain just how prominent this phenomenon is in everyday life. Yet none of us would doubt that there is a genuine warming-up effect, at least in such predominantly muscular work as characterizes athletics. Only after he has thrown a number of balls is the pitcher capable of either maximum speed or control.

End-spurt occurs only when worker knows work period is about completed. — It frequently happens that there is a rise in the level of efficiency near the end of the work curve. This rise takes place only if the worker has some notion as to when his work will be completed. As he realizes that the end is near, he apparently settles down to his task with new interest and ardor. Perhaps the most important fact demonstrated by *end-spurt* is the degree to which the level of the work curve can be changed by the introduction of some additional incentive.

Performance at one kind of work affects capacity for others. — Up to the present we have been talking about the effects which continuous performance at one kind of work have upon the efficiency of that work itself. Thus it

was the doing of mental multiplication that caused a general decrement in efficiency for mental multiplication (Fig. 19); it was the too energetic performance of arithmetical work that caused the falling off of the early high efficiency (Fig. 22); and it was the actual recitation of the reversed alphabet that led to the increase in efficiency in that particular work (Fig. 23). A moment's consideration makes clear, however, that efficiency in a given type of work is also capable of being affected by performance at other kinds of work. After a very long walk one may find himself too tired to read effectively, or after a strenuous day of trying to sell life insurance a salesman may be unable to play billiards with his usual accuracy. There is a possibility, too, that warming-up for one task may increase one's efficiency for certain others, although this case is not so familiar as that of the transfer of decrement from one task to another.

There has been a good deal of thought about how working at one task may decrease efficiency for another. One theory was to the effect that the loss in efficiency which results from continuous work, *i.e.*, the general decrement, is caused by the depletion of some general supply of energy at the worker's disposal. Whether continuous performance of one kind of work would affect efficiency for another would depend, then, simply upon the amount of this general supply of energy used on the first task. This theory is not acceptable, because there is no general energy supply which is drawn upon for all kinds of work. Each special kind of work utilizes energy stored up in the particular nerves and muscles involved in that work.

There is a somewhat better theory, to the effect that loss of efficiency in one kind of work will carry over to another only to the extent to which the two tasks have certain features in common. For example, one psychologist found that the

capacity to judge weights lifted by the right hand was lowered if the subject first tired out that hand by squeezing a metal grip. The capacity to judge these weights was not affected, though, by a half-hour spent in translating difficult German. It is evident that there was more in common between weight judging with the right hand and squeezing the grip with the same hand than there was between weight lifting and translation. The basis for some cases of transferred decrement is not nearly so plain, but this matter of the factors in common between two tasks must always be taken into account when seeking the explanation of how the continuous performance of one kind of work affects the efficiency of another kind.

There are, of course, some types of activity which involve almost every part of the body. This is true of violent physical exercise and emotional excitement. Prolonged activity of these types is likely to leave one in such a condition that any kind of work is difficult.

C. Effects of Factors Other than Work Itself

Efficiency determined by work methods. — We have already seen how the method of procedure in a given task affects the rate of learning and the limits of improvement. But, leaving aside the question of learning, the method of work still has an important bearing upon efficiency. Every one of us has better and worse methods of performing at the same task. Sometimes we employ a better method and sometimes a poorer one, and our efficiency varies accordingly.

For most tasks there is one speed of work that will result in a greater degree of accuracy than will other speeds. Ordinarily we assume that the greatest accuracy is attained where the work is performed very slowly. This may be true when the work is highly complicated. It is not true

when the work is relatively simple. An experiment was carried out in which the subjects were required to judge the differences between pairs of lifted weights and also the differences between the lengths of different lines. The results show that these comparisons were made most accurately at a medium speed. Accuracy was low when the work was done too slowly, as it also was when it was done too rapidly. Anyone who has ever fired a rifle knows that there is an optimal time for aiming. Poor shooting may result from aiming either for too long or for too short a time.

Speed is only one of many elements in the method of work. We may try harder to succeed at one time than at another, and this fact is also capable of affecting efficiency. The situation here is something like that in the case of speed. A medium degree of effort is often better than too much or too little effort. Many a task is poorly performed because the worker is too anxious or not anxious enough to do well. The rhythm with which work is done, the particular muscles used, and the direction of the worker's attention are other factors of method which have their effects upon efficiency.

The worker's surroundings determine his efficiency. — In an earlier chapter (p. 103) we showed how learning can be affected by distractions. This is true also of tasks at which our efficiency is no longer improving with practice.

The influence of surrounding conditions can best be considered by a classification of those conditions. We are at all times acted upon by a large number of stimuli. Some of these are vital to the performance of the work at hand. The objects in the street, the "feel" of the steering wheel and the brake are essential elements in the environment of the chauffeur. So long as he is affected by these things, efficient driving is possible. But anything that acts to cut off these vital factors will seriously interfere with his ability to drive.

There are always present other factors also that have no such evident relationship to his work of driving. Among these are the talk of the passengers in the back seat, the sights along the sides of the street, and so on. If he is accustomed to these relatively extraneous factors, they may not interfere with his work; they may even be of a certain amount of assistance. On the other hand, he may tend to react to them in a way which disturbs the efficiency of his driving. In that event we speak of them as *distracting stimuli*.

Motives determine efficiency. — When a worker who has been performing at one level of efficiency for some time realizes that the end of his work is approaching, he is likely, as we have seen, to increase his efficiency. The knowledge that he is about through supplies him with a new interest in the task. Now anything that can strengthen our interest in the work we are doing can similarly bring about an increase in efficiency, unless, of course, we are already working at the limit of our capacity. The fact of the matter is, however, that we rarely are working even near the limit of our capacity. For this reason, new and stronger motives for doing well almost always have some effect.

It would be quite impossible to list all of the motives which are capable of affecting human efficiency. There are as many motives capable of affecting performance at any task as there are interests which can be brought into relationship with that task. There are certain motives that have very widespread effects. Among these are rivalry and financial gain. There are others which are more temporary and which are chiefly effective for a limited number of tasks.

With strong enough motives great difficulties can be surmounted. — Nowhere has the effectiveness of strong motivation been better illustrated than in psychological

experiments which have been conducted for the purpose of discovering the influence upon efficiency of certain unwholesome conditions, such as loss of sleep and starvation. The subjects of these experiments have felt the deprivation of sleep or food, and in their casual reactions they have shown that their efficiency was being affected. But when they have been subjected to formal laboratory tests (when, for instance, they have been called upon to work at mental multiplication), they have demonstrated the most astonishing ability to pull themselves together. Several experiments were conducted a short time ago in which persons went without sleep for several days. At the end of that time they felt badly and in their conversation and other ordinary activities they made many slips, but when put to a difficult task, where they knew their performance was to be scored, they worked as well as usual.

The power of strong motivation has similarly appeared where workers, in their enthusiasm, have overcome the handicaps of poor health. Many a brilliant career in art, science, and business has been possible only because the desire to do well has enabled the worker to overcome great obstacles.

There is some danger of underestimating the importance of poor health and unwholesome habits merely because of the fact that we have such a capacity for surmounting difficulties. We may be as able as ever to do the day's work after having gone without sleep, or during a period of bad health, but there are definite limits to what mere motivation will accomplish. If we deprive ourselves of proper rest habitually, there are likely to be long-run effects which cannot be so easily overcome. Furthermore, we can look at it in this way: Even though a man handicapped by bad health may work efficiently, his efficiency will be attained only at the

expense of greater effort. And no mechanic would consider it good policy to run his engine at full speed to accomplish what it ought to accomplish at half speed.

Summary of the Chapter

1. Although the growth and decay of habits are responsible for much of the variation which occurs in human efficiency, there are other factors of first-rate importance. There are, in other words, influences which affect the operation of habits as well as influences which affect their acquisition and loss.

2. Efficiency has different meanings. Accuracy or quality, speed, and ease of performance are important ones. These meanings of efficiency do not merely stand for some ultimate kind of efficiency which lies behind them. They are, themselves, *real* efficiencies.

3. Accuracy, speed, and ease of performance are general rather than special kinds of efficiencies. Each of the terms, accuracy, speed, and ease of performance, has many special meanings according to the type of work considered.

4. The work curve represents the changes which take place in efficiency as a result of continuous performance at the same task. The most frequent fact indicated by such curves is a loss in efficiency known as the general decrement or "fatigue" effect.

5. The amount of decrement which a given period of work will produce depends upon the continuity of the work, its simplicity, and the particular meaning of efficiency considered. In general, the more continuous and the more simple the work, the more marked the decrement. As a rule, satisfyingness is lost before accuracy, and accuracy diminishes earlier than speed.

6. There are several factors which probably enter into the

production of the general decrement. Continuous work may utilize supplies of energy in the body tissues faster than these can be rebuilt again. In the consumption of these energy supplies there are produced certain waste products which may have a poisonous effect upon tissues and diminish the efficiency of their action. And there are also produced by continuous work sensations and feelings which render further performance extremely disagreeable and difficult. Our knowledge about the relative importance of these different factors is vague.

7. The work curve sometimes shows an extraordinarily high level at its very beginning. This is known as *initial spurt*. It may be due to a tendency of the worker to overestimate his actual capacity, or to the fact that, at the beginning of the period, his mind is fairly free of anything which would interfere with his performance.

8. While not all work curves indicate a *warming-up* or early rise in efficiency, many show this effect clearly. Warming-up is essentially a matter of getting settled to the work. It is a phenomenon which is very generally recognized in everyday life.

9. *End spurt* is a rise in efficiency at the very end of the work period. It is dependent upon the worker's knowing that the work period is approaching a close, and its chief importance lies in the illustration it affords of what the entrance of a new motive can do to the level of efficiency.

10. The continuous performance at one task will affect our performance, not only at that task, but at certain others as well. The transfer with which we are most familiar is of the general decrement. The possibility of such transfer has been explained by some as due to the dependence of all work upon some general source of energy. This theory is untenable, because the energy used in work is drawn from

the tissues actually involved in that work. This means that there can be a transfer of "fatigue" only when two kinds of work involve certain factors in common.

11. Efficiency is, of course, affected by factors other than continuous work. Prominent among these are the method of working, the surroundings, the motives for working, and the health and general fitness of the worker.

PROBLEMS

1. The efficiency with which you read this chapter will depend upon how much psychology you have already learned and upon how much of that subject you have forgotten. Upon what other factors will it depend?

2. What determines whether accuracy, speed, or ease of performance will be considered the most important meaning of efficiency for a given kind of work?

3. Cite a case where accuracy is more important than speed for a certain task performed under one set of conditions and speed more important than accuracy for the same task performed under different conditions.

4. Let each student have before him on his desk six to eight large sheets of paper. These should be numbered consecutively, and in the experiment to follow they should be piled according to number and used according to number. Let each student also have two pencils with good points, but not points which are so sharp as to be easily broken. The class is to be divided into halves. When the instructor says, "Go!", one half of the class will write as fast as possible *abababababab* and so on, and the other half will write *abcdefabcdef* and so on. The writing will continue for ten minutes, after which the instructor will say "Stop!" During the writing the instructor will say, "Now!" at the expiration of each half-minute and each student will thereupon draw a line through his writing at the point he has reached. Plot from the results two work curves, one showing the average number of letters written by one half of the class in each of the successive half-minutes of work, and the other showing the performance of the other half of the class. Interpret these curves.

5. Can you think of any other factors which may determine the amount of decrement in a curve of work besides the continuity of the work, its simplicity, and the meaning of efficiency considered?

6. Why do you suppose that hard "intellectual" work shows a less marked decrement than hard "muscular" work? For instance, an oars-

man who started rowing at top speed and who tried to continue this for twelve hours would show a much greater loss in efficiency than was shown by Miss Arai, a psychologist, who worked as fast as she was able for the same length of time on the mental multiplication of four-place by four-place numbers.

7. Which is considered the more important factor in athletic performances, initial spurt or warming-up? What bearing upon this question has the fact that baseball players practice before the game?

8. Why would it be impossible to have end spurt if the worker had no idea of when the work period was to end?

9. Which would affect one's ability more widely, listening to a lecture until bored or running until badly out of breath? Why?

10. What are some of the motives which are capable of affecting almost anything you do? What are some which are capable of affecting only a limited number of your activities?

REFERENCES FOR FURTHER STUDY

Readings in General Psychology, Ch. XXII, Selection 1, p. 638 ff.

Coriat, *Abnormal Psychology*, pp. 88–96; or *Readings*, Ch. XXII, Selection 2, p. 658 ff.

PART III

PERCEPTION

CHAPTER VII

PERCEPTION AND ATTENTION

A. Perception
B. Attention
C. Preparation for Movement

Questions to Keep in Mind while Reading this Chapter

1. How do we learn to know what is going on around us?
2. To what sorts of things do we pay attention?

In Part II we dealt with habit. We showed how experience modifies, sometimes for better and sometimes for worse, every type of human activity. In the remainder of this book we shall not forget for one moment that habit formation is fundamental throughout the whole domain of psychology. But we shall turn now from the general principles of learning to some special types of human activity.

One special type of activity is *overt bodily movement*, the sort of movement that can be readily observed. We shall not, however, give overt bodily movement any special treatment in the pages to come, for the reason that this subject has already had fairly full discussion in the chapters on habit formation and learning.

Another special type of activity is *knowing* or *cognition*. Knowing is of two basic types. One of these is called *perception*. It is the knowing of objects and events which are, at the time of our knowing them, acting upon our sense-organs. Perception will be the main topic of the two chapters which make up Part III. The other type of

knowing is called *ideation.* It is an activity in which we are able to know objects and events even though they are not at the time acting upon our organs of sense. Part IV is reserved for the treatment of ideation.

A. Perception

Perception is going on during all waking hours. — Except when asleep or absorbed in thought, we are perceiving something or other. Scarcely had I opened my eyes this morning when I perceived the cloudiness of the sky. Then I turned my eyes toward the clock and perceived that it was seven. A moment later I perceived that I was still in bed. And so it goes through the day. I perceive the balmy autumn breeze, the people going by, the sounds of the chimes floating out from the chapel tower, the cramp in my arm held too long in one position, and, at noon, the fact that I am hungry.

As I pass from the perception of one thing to that of another, the transition is usually not sharp. One act of perception fades gradually into the next. Look at a coin for several moments. If you observe yourself carefully, you will see that you have not made a single prolonged perception. First you perceive the coin as a half-dollar, then you perceive the figure on it, then its roughened edge, then its date; and these acts of perception so run into each other that you are unable to tell precisely when one act of perception begins and the other leaves off.

Perception is active understanding. — A few moments ago I heard a clanking and roaring. I *perceived* this noise as that of a steam shovel operating a block away. In order to account for this perception we must realize, first of all, that this sound acted upon the sense-organs of hearing which are in the ear. From the ears nerve impulses must have

gone to the brain and probably out again to the muscles, though I was not aware at the time that I was moving in response to the sound. But this action of the sound upon sense-organs, nervous system, and muscles is not all that happened. Remember that my perception was that of a steam shovel a block away. This means that there was, on my part, an active interpretation of the sound. Not only was I affected by the sound; I gave that sound meaning. A person might have heard such a sound quite clearly without appreciating it as the sound of a steam shovel and without even appreciating the direction from which it came. It is true that he would almost surely have given it some sort of meaning, but the point is that the meaning is a reaction of the perceiver and not an intrinsic part of the sound itself.

From our discussion thus far it might be supposed that a perception is simply sense impression plus certain meanings which the perceiver adds. But the act of interpretation goes deeper than that. Besides adding meaning to what we seem to get through our senses, it also alters the character of those sense data. Dr. Grace Kinckle Adams has collected some incidents that admirably illustrate this fact.[1]

I was walking down the street and saw the smoke coming out of one of the near-by houses. There was a lot of the smoke and it had the characteristic bluish tinge of the smoke from a fire burning well, out-of-doors on a clear day. As I walked on, I noticed that the smoke had no movement at all. So I looked more intently and realized that it wasn't smoke at all, but the snow on a steep bank behind the house. The trees near the house had given the smoke its proper shape, but most of the blue faded out when I realized that it was snow. Also the texture of the snow seemed to be thicker and rather rougher.

[1] *American Journal of Psychology*, 1923, Vol. 34, p. 359 ff.

We had chocolate pudding for dinner. Late in the afternoon, I went to the refrigerator and got out a bowl of the pudding. I put sugar and cream on it and began to eat it. I was swallowing the first mouthful when I noticed that something was wrong. Immediately what I had in my mouth tasted salty and greasy, and I realized that it was gravy. I cannot say that it tasted just like the pudding before this, but it had certainly tasted much more like it than it had like gravy.

In each of these cases we have two perceptions, a first one which proves false and a second one which proves correct. The difference between the false and the correct perception is not, however, simply between the meanings attached to sense data under different conditions. There is also a marked difference between the apparent nature of the sense data, themselves. The snow looked blue while it was considered to be smoke, but the blue faded out when the perceiver realized that he was looking at snow. The gravy did not taste a bit like gravy until the perceiver realized that it was gravy.

Perceptual reactions are habits. — Consider for a moment that you are looking at a closed book for the first time in your life and that previously you have never even heard of a book. What would your perception be like? One thing is clear, and that is that you would not perceive the object before you as a book. If you had had considerable experience with solid blocks you might perceive the book as solid. If, on the other hand, you had had considerable experience with small boxes, the chances are that you would perceive the book as hollow. And, finally, if your experience had not yet taught you the distinction between solidness and hollowness, you would not perceive the book as possessing either quality. Knowing a book when you see one is an intellectual habit, acquired like any other habit, as a result of definite past experiences.

We all have such firmly fixed habits in regard to books that it is somewhat difficult for us to conceive of ourselves as ever having been unable to perceive such things. But there is evidence of another sort which proves equally well that what we are able to perceive depends upon experience and training. "Among different persons viewing the same point in a landscape under exactly similar outward conditions," says Professor Seashore, "the botanist sees the cause for the shape of the overhanging trees, the artist sees effective shadows for the setting of a sketch, the carpenter sees a good location for a cottage, the farmer sees the rich clover going to waste, and the summer girl sees the location for a romance."[1] He goes on to quote another author who is discussing the different ways in which different people perceive an irregular ink-blot. "To the hunter it is a beaver or a woodchuck; to the naturalist, a hedgehog or a flounder, according as his mind has been directed to land animals or fish; to the mason, a trowel; to the keeper of pets, an Angora cat."[2] The proper conclusion to be drawn from these facts is that our manner of perceiving things is as much the result of particular experiences as is our skating or typewriting.

FIG. 24
WHAT IS IT?

Another good illustration comes from the blind. You have probably heard it said that blind people have a remarkably keen sense of touch and that they can judge things

[1] *Elementary Experiments in Psychology*, p. 146 (Henry Holt and Company).
[2] *Ibid.*

by their "feel" in a way that would be impossible for most of us. Now, it is interesting that the actual sense-organs in the skin of the blind man's fingers are no more sensitive than those of the rest of us. But lack of eyesight has forced the blind man to utilize touch to a great degree. As a result of this special training, he has gained an unusual capacity to interpret minute details about the "feel" of objects which seeing people have never learned to notice.

Illusions are sometimes due to habits of perception. — Although, as a rule, our habits of perception make us better able to size up situations promptly and efficiently, they sometimes lead us astray. Out upon the water we learn to perceive the distant, hazy, white object as a sail, but one of these days it turns out to be a cloud. Dr. Breese had an experience the general principle of which has probably been illustrated in the lives of all of us. "Several years ago I was very much annoyed for several weeks by the explosions of dynamite, which was being used to blast out the rock for a sewer on the avenue in front of the University. A year after the work was completed I was startled one day by hearing an explosion of dynamite directly in front of the University building. I immediately went to the window to see if the work had recommenced on the sewer line, but I was unable to locate any workmen on the street. It was empty. Within the next half-hour I distinctly heard several explosions. I was, however, unable to account for them until I discovered that the sounds that I had perceived as explosions came from a French casement window which had been opening and closing in the wind."[1] Thus the habit, established a year before, of perceiving loud sounds as dynamite explosions led the perceiver to misinterpret the sound of the slamming window.

[1] *Psychology*, p. 199 (Charles Scribners Sons).

Off at the side of my workroom there is a square-topped table. From where I sit the table looks, as it really is, perfectly square. If, however, I should draw a picture of the table, as viewed from where I sit, and if I should represent the corner angles by right angles, the table would appear all out of shape. Very young children do represent by a right angle any angle that is perceived as a right angle, and we all know how distorted their drawings appear. From where I sit two of the angles of the table top come to me as obtuse angles and the other two as acute angles. I perceive them all as right angles because past experience has taught me that obtuse and acute angles seen as these are seen are really right angles. This illusion of perceiving certain acute and certain obtuse angles as right angles differs from Dr. Breese's explosion illusion in that everybody experiences it. Most people have not had and never will have a tendency to perceive all loud sounds as dynamite explosions, because they have not had sufficient experience with dynamiting. Everyone who can see, on the other hand, soon has enough experience with angles to set up the table-top illusion and many others similar to it.

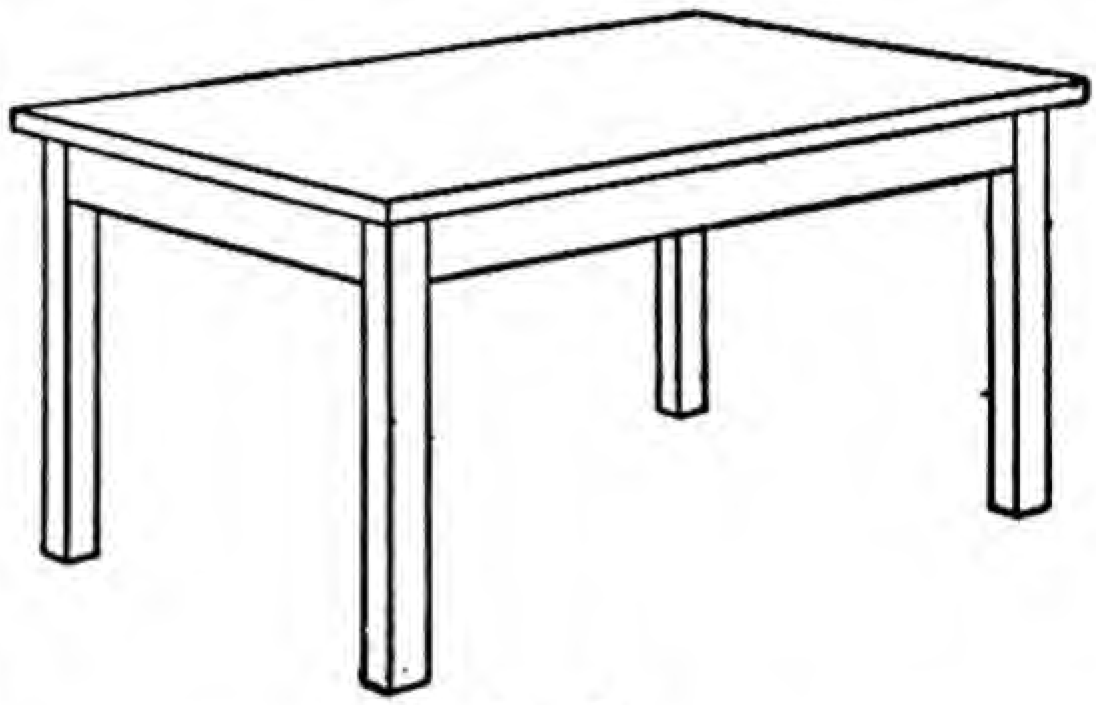
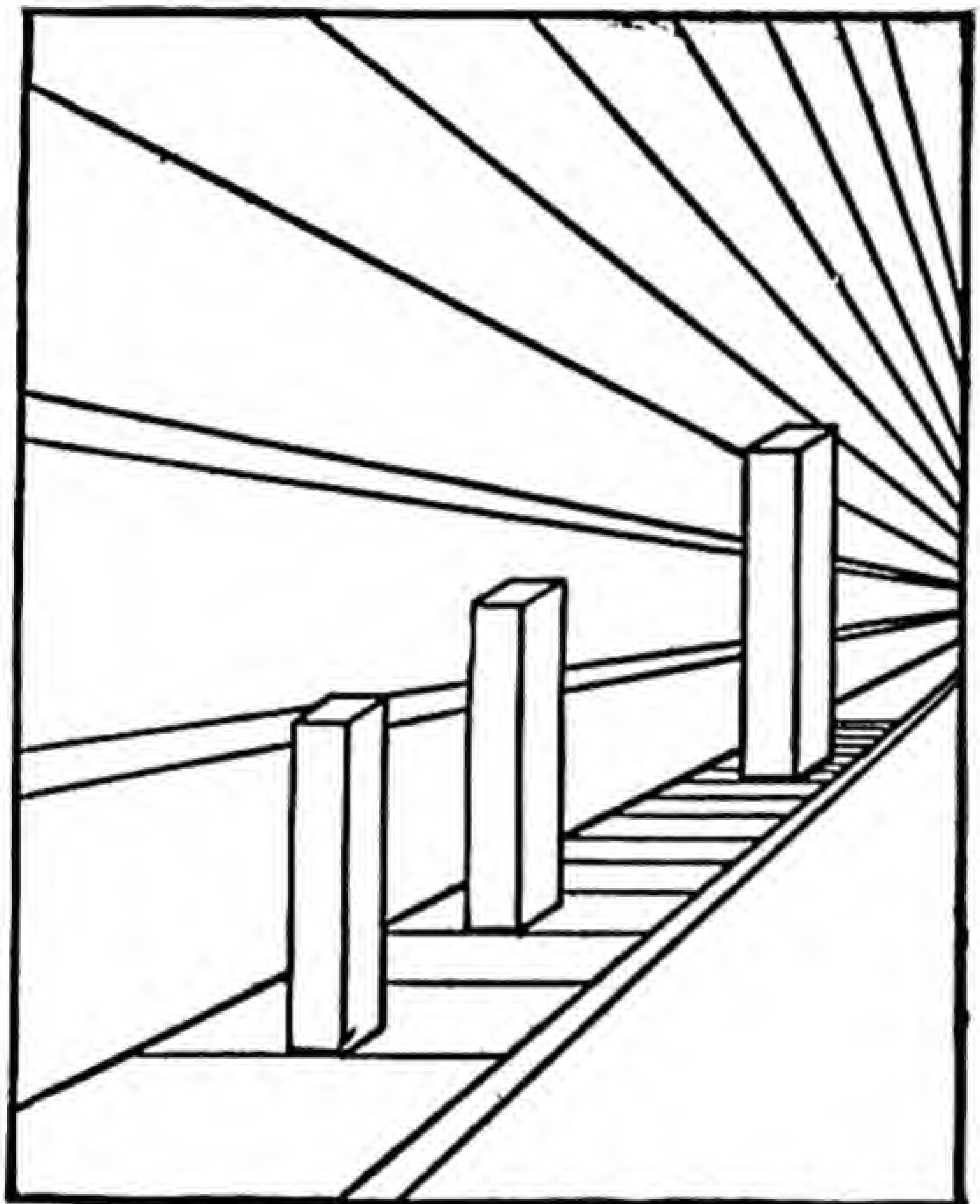


FIG. 25

How many angles of this table top look like right angles? How many are actually right angles?

These illusions, that everybody can be counted upon to have, serve useful purposes in the theater and in drawing and painting. Experience gives us the habit of perceiving deep,

prolonged, rumbling noises as thunder. If a similar sound is produced by metal plates behind the scenes, it does very well as thunder. Experience has taught us to perceive a shower of white particles as snow. A shower of white paper on the stage, therefore, does very well as a snowstorm. Experience has taught us that when the edges of a sidewalk, let us say, tend to come closer and closer together, it is not because they actually do converge, but rather because they are getting farther and farther from the eye. This principle can be taken advantage of in drawing. The edges of the walk and the seams on the side wall in Figure 26 actually do converge, but we are so accustomed to perceive converging lines as receding into the distance that we interpret the lines in this drawing in the same way. Experience has taught us that although certain objects are actually the same size, the nearer ones appear larger. We allow for this in perception. The posts in Figure 26 are in reality of the same height, though the



Courtesy of the D. Van Nostrand Company

FIG. 26. — AN ILLUSION OF PERSPECTIVE

(Reprinted by permission from Luckeish, *Visual Illusions*.)

more distant one is perceived as larger than the other two. If it were really more distant it would have to be larger than the other two in order to make the same impression on the eye.

We perceive what we expect to perceive. — Figure 27 can readily be perceived as the head of a rabbit or as that of a duck. If we have in mind a rabbit as we look at the figure, we perceive the rabbit's head; but if we have a duck in mind, we perceive a duck. Figure 28 is at first perceived as a brain, but if one is told that it is a group of infants he will readily perceive it as such. Most children when they look at the full moon, expect to see the front view of a face, and that is exactly what they do see. It is a well-known fact, however, that there is also a side or profile view of a face which can be seen in the moon, if one expects to see it. Thus we perceive what we expect to perceive; that is, our perception depends upon the general state of mind we are in.

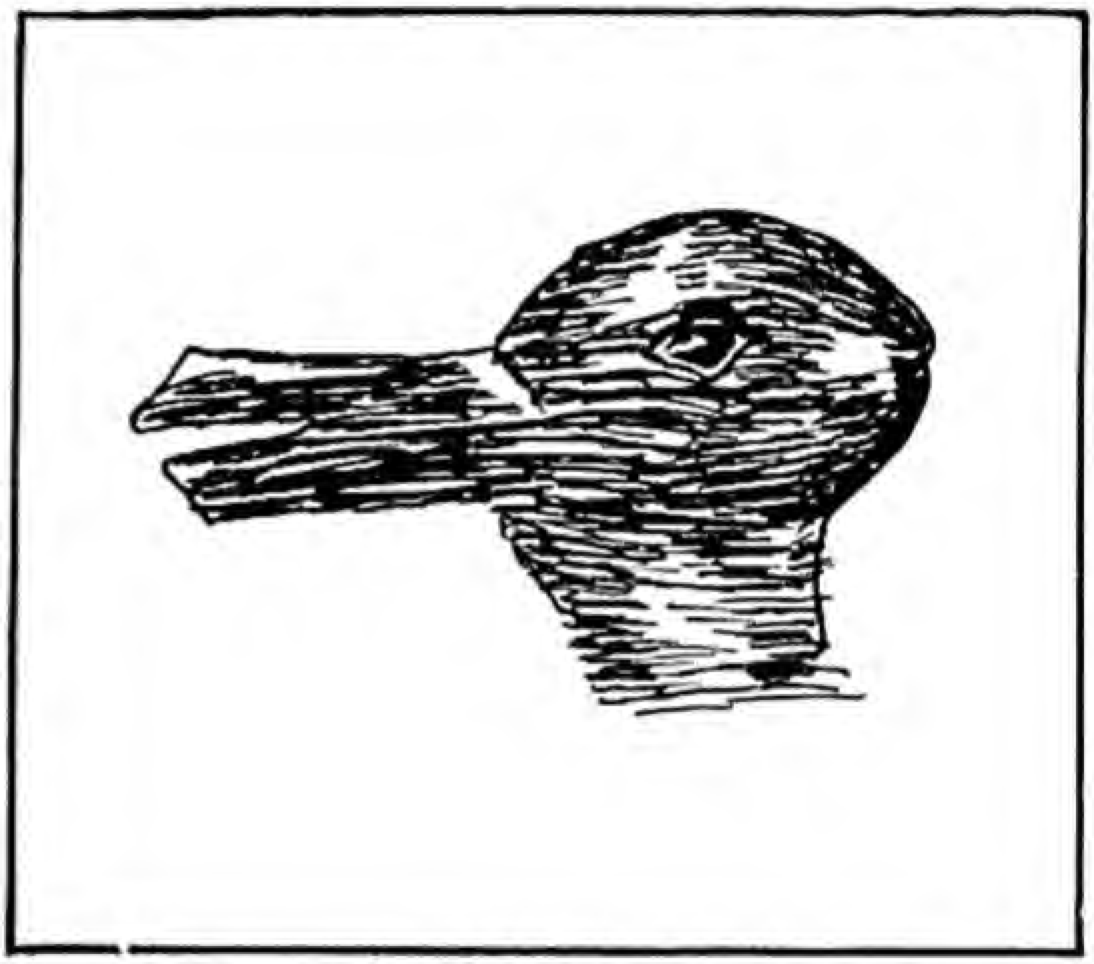


Fig. 27. — And What is This?

(Drawn from Fliegende Blätter.)

One day, just as I was coming out of a drug store, I saw two men pass immediately before me. They were running. A moment later I saw a large red flame beside a motor truck which was standing in the street. Naturally I was puzzled

and, as I looked more closely, I realized that the flame was simply a splash of sunshine on the side of the red truck. Now what was the cause of my first erroneous perception? Of course there is, after all, a remote resemblance between a red surface and a flame. But there were many facts which were apparently against the flame interpretation. For instance, the "flame," as I perceived it, was coming right out of the cement pavement. Evidently something must

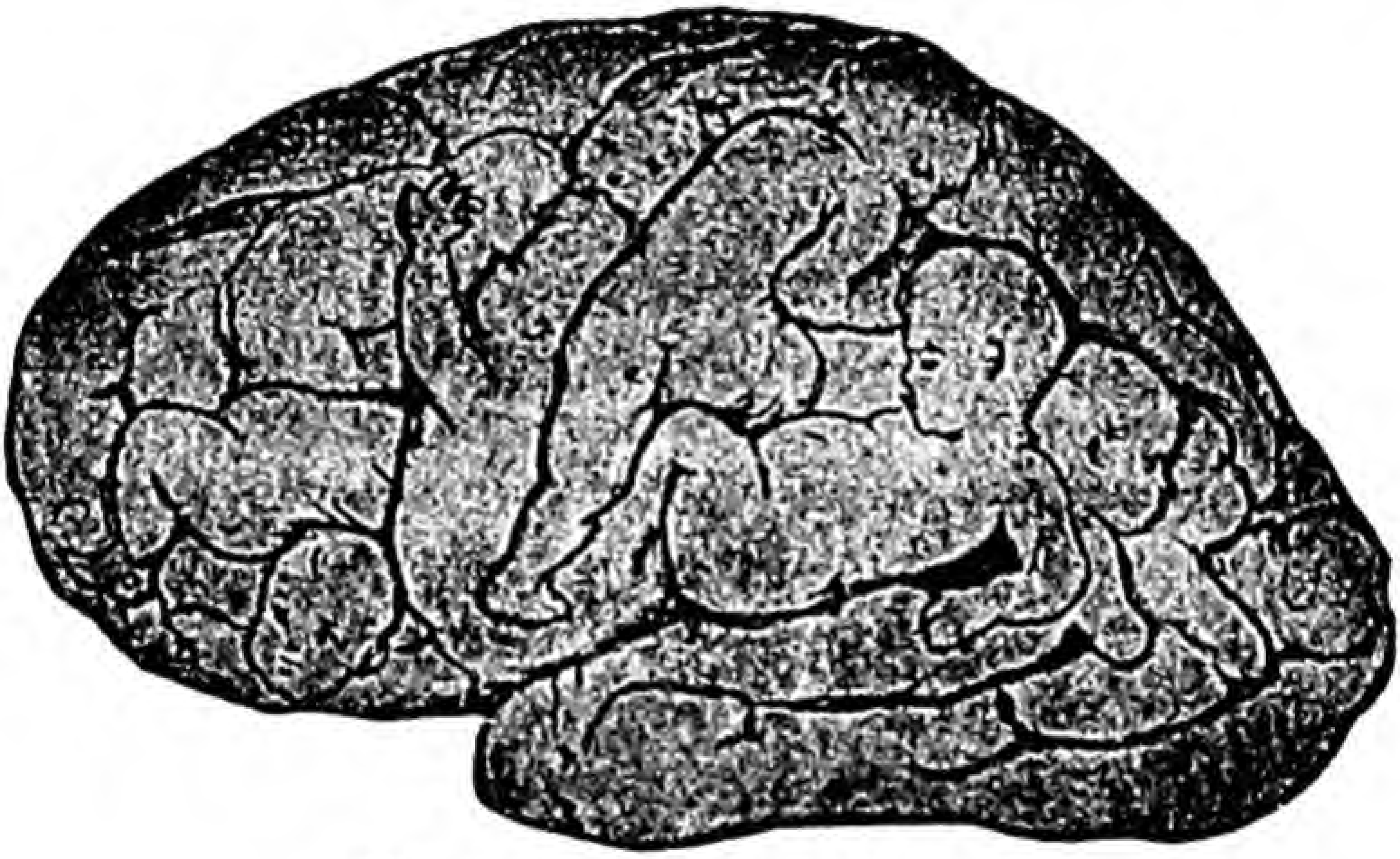


FIG. 28. — WHAT DO YOU SEE?

(Drawn by R. Gudden; taken from Titchener, *Textbook of Psychology*.)

have influenced me to perceive the red splash as flame. Probably the determining factor was the state of mind that I was in as my eyes turned upon the truck. Two men had just passed me. They were on the run, which is slightly unusual for men in a city street. When one sees grown people running he is quite likely to think of fire, robbery, and other matters of that type. Now, so far as I remember, I did not consciously ask myself whether these men were

running to a fire, but, having seen them running, I was prepared to entertain ideas about fires. This readiness was in all probability the real reason why my perception took the form it did.

Expectation plays an important part in determining the nature of perception, especially when the sights or sounds that confront us are of such a doubtful nature that they may be interpreted in any one of a number of different ways. That was true of the rabbit head (Fig. 27) and it is also true of the staircase of Figure 29. The lines in the latter figure will represent either a staircase viewed from above or one viewed from below, and which of these two is perceived is governed to a marked extent by what one expects to see. We have all experienced the illusion that the railroad car in which we are seated is moving, when what is actually moving is the train on the next track. When we look out of the car window in such a way as to see only the moving cars of the train on the next track, the impression made upon our eyes is the same impression as that which would be made if our car were moving and those on the next track stationary. Under such circumstances we could perceive ourselves as moving or the other train as moving. The probable reason why we usually perceive our own car as the moving one is that we are actively expecting it to move at any time, while we are thinking scarcely at all about whether or not the other train is going to pull out.

There is an old saying that he who goes around looking for trouble is sure to find it. Knowing, as we do, what a great effect expectation has upon perception, we can well understand why this is so. The "touchy" individual who is in constant dread of being slighted will read a slight into the best-intentioned actions of those about him. The opposite extreme to the touchy person is also interesting.

He is the individual who is blessed (or cursed) with perpetual confidence that others simply cannot help but compliment him. Always expecting compliments, he perceives

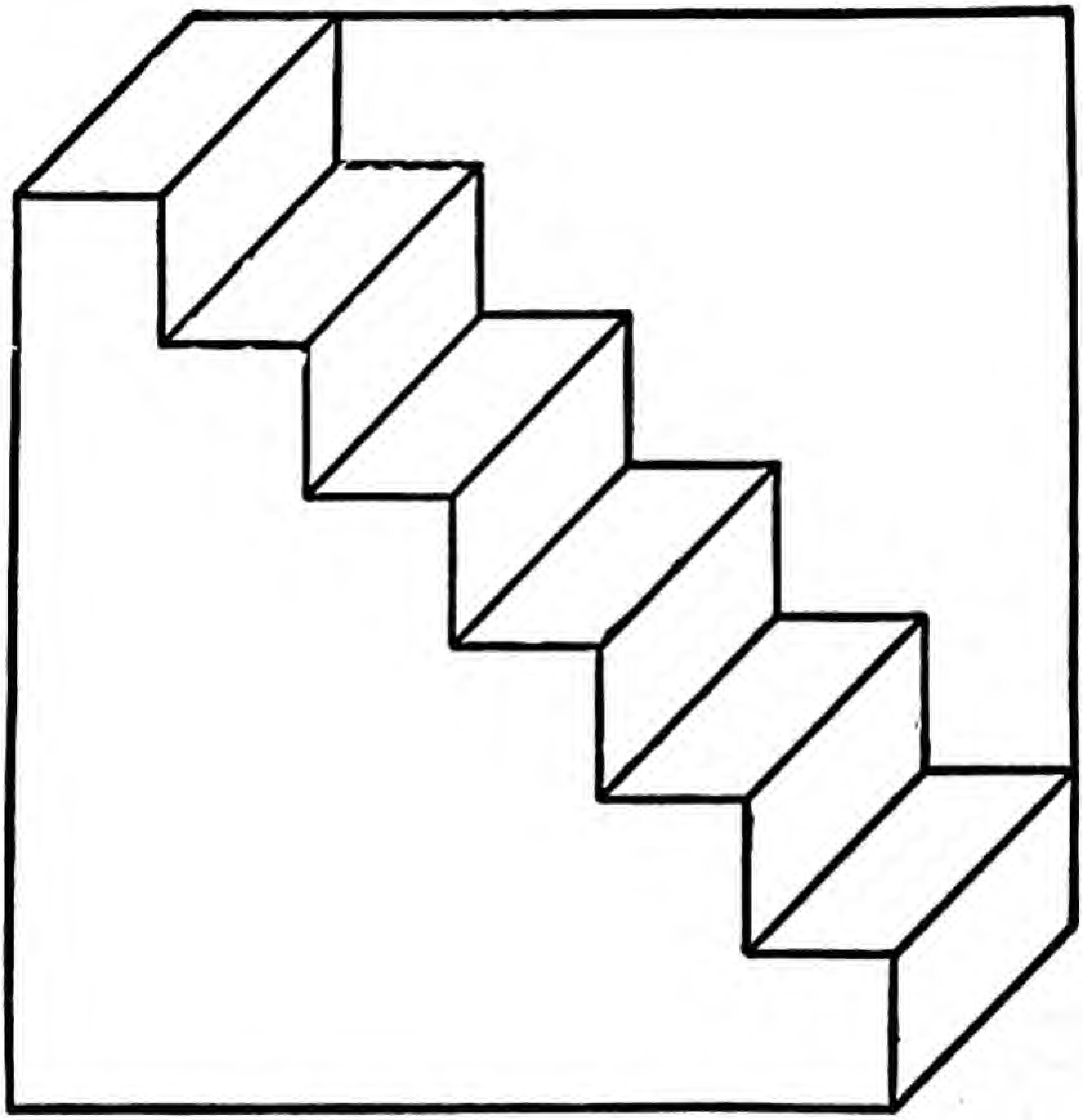


FIG. 29. — A REVERSIBLE PERSPECTIVE.
Does this represent the upper or the under side of a stairway?

them in every reference made to himself. Such individuals are almost incapable of being insulted.

But expectation does not always produce illusory or false perceptions. There are certain kinds of situations where

it is vitally important for accurate perception to take place without a moment's hesitation. The physician, the fireman, the soldier, the sea captain, and the business executive face some conditions which simply cannot be reasoned about. Their nature must be perceived at once. The physician, therefore, must be on the lookout for disease, the fireman for the collapsing wall, the soldier for the surprise attack, and the business executive for the source of financial loss, so that these things, when they do occur, can be appreciated without delay.

While perceiving we are aware of only a part of that process. — When we wish to account for why we perceive Figure 27 as a rabbit's head, we have to take into consideration the fact that we have previously seen rabbits and pictures of rabbits. Without our present attitude and past training our perception would not be what it is. It is natural to suppose that when we are perceiving, we are consciously comparing present sense impressions with past experience and with what we were expecting. Nevertheless, self-observation fails to reveal any such conscious comparisons. At the moment of perceiving we are aware that what we perceive is a rabbit's head, but we are not aware of past experience with similar objects or of our state of expectancy just before perceiving. A certain kind of past experience and, sometimes, of expectancy, are necessary before we can perceive a rabbit's head, an orange, a sunset, or anything else; but that does not mean that we are conscious of them while we are perceiving.

It is one of the virtues of perception that it is affected by our past training without our needing consciously to run over all of that past training. Suppose that every time an old friend appeared, one had to recall consciously all previous meetings with him before one could accurately perceive

that it was a friend. Think how much time it would require to be an intelligent person! As it is, those past meetings have their effect, and without one's stopping to recall their previous occurrence.

Sometimes past experience does not act so smoothly and unconsciously; sometimes one does have to stop and think where he has seen this object or person before. This is usually where the past experience has been superficial. Where one has had much experience with a particular object or person, one perceives immediately and does not have to stop and think.

In order to attain great skill in any walk of life, it is necessary for a man to learn to perceive many things, to know them when he meets them without having to stop and figure out what they are. The expert silk dealer can evaluate a fabric immediately upon feeling it and the expert cattle dealer knows a good steer almost at a glance. Of course it takes time before one can know the nature of a complex object or situation at once and without much thinking, but such ability is worth the time it takes to acquire. When you were first learning to read you had to stop and think about almost every word. But now that you have attained skill in reading, you are able to take in whole phrases and sentences in a single act of perception. As a consequence you can read faster, and you therefore have the time at your disposal to consider the meaning of what you read and to wrestle with the problems that are really difficult enough to deserve thought. The same is true of the daily tasks of the man in a profession or business. It is only because he has learned to perceive, to take in at a glance, so to speak, most of the things that come up during the day, that he has the time and energy necessary for thinking about his more difficult problems.

How much can we perceive at once? — As I sit here at my desk, I clearly perceive the typewriter before me. In a vague way I am aware of the presence of the desk upon which the typewriter rests, of the feel of my feet resting upon the floor, of the light just above and to my left, of the slight noise of someone moving about in the next room, but these I can scarcely be said to perceive. I *sense* them, I am faintly affected by their presence, but I do not at the moment actively know what they are. Of course I can perceive each of these in turn; the point is simply that, at the moment of perceiving the typewriter, I am not also perceiving all the other objects affecting my senses at the same time.

We have seen that a single act of perception is limited in scope. It does not take in everything in our immediate vicinity. But how much can it take in? That is a question which has been raised many, many times. Experiments have been conducted to settle it, and we may do well to examine one of them. The experimenter has printed on a white card the following group of letters:

iiaedlhapphl

He covers this card with another card and tells his subject to watch closely. Suddenly he uncovers the group of letters just long enough for the subject to have a momentary glance at them. Then the subject writes down as many of the letters as he is able to perceive. You may be sure that, at most, he is able to write down only a very few of them. Now the experimenter has still another card upon which are written the same letters, but in a somewhat different order. Let us say that the order is as follows:

Philadelphia

This card is exposed in the same way as the first and the subject is again asked to write down the letters he was able

to perceive. This time he is almost sure to write all of them.

The experiment we have just considered tells us a good deal about how many things can be perceived at once. It tells us that the number of things which can be perceived at once is great when those things are arranged as we are accustomed to having them, and that the number of things which can be perceived at once is small when they are grouped together in some unusual way. This does not hold for letters alone. If one glanced at a familiar machine which had been taken apart, his perception of it would be fragmentary and inadequate. In the same length of time, however, a very good perception could be had of the machine in an assembled state.

Philadelphia is perceived promptly and accurately in a single act of perception, because we are familiar with that grouping of letters. *Iiaedlhapphl* requires a number of distinct acts of perception, because we are unfamiliar with it. From this we can see that it is experience and experience alone which can increase our capacities to perceive. We came to the conclusion that the man of great skill in any walk of life must, as a result of experience, have learned to perceive the nature of situations that the less skillful are required to think about in order to identify. In the development of intellectual skill it is necessary to do more than to acquire the capacity to size up a wide variety of situations at a glance. It is necessary to acquire the capacity to take in at a glance situations of great complexity. Although almost all grown people in this country are able to read, some are very much more efficient readers than others. Perhaps the main reason for this is that some are able to take in perceptually larger groups of words than others. Inefficient readers often pronounce to themselves every word that they

read, whereas efficient readers comprehend a whole phrase or sentence in a single act of perception. The same sort of difference exists between the efficient and inefficient in many other lines of endeavor. The skilled football player, chauffeur, banker, and lawyer are able to take in at a glance highly complex situations. As we have said, this kind of capacity, like most others, requires experience and training for its development. A complex situation must be met again and again before we can hope to take it in at a glance.

B. Attention

Perception and attention are closely related. — When I want to perceive a printed page, a voice, or any other object or occurrence, I pay attention to it. Without paying attention to an object I cannot perceive it clearly. This attending to an object means getting oneself into a condition where the object is best able to have an effect. Consider the case of looking at the coin. First you pay attention to the object as a whole and you perceive it as a half-dollar. Then you pay attention in turn to its roughened edge, its date, and so on. Under these circumstances the shifts in attention, which bring about the perception of first one and then another thing about the coin, are mainly shifts in the focus of the eyes. The eyes focus upon different parts of the coin, and each fixation makes possible a new act of perception. But one can pay attention to sounds as well as sights, and it is not possible to focus the ears in quite the same way in which one focusses the eyes. Still, there are a number of things that can be done to make one ready to perceive sounds. One can sit quietly and make a mental preparation to hear. One can think about the voice one is listening for, and that in itself will, as we have seen, aid in the act of perception. Similarly one can prepare to perceive a

touch upon the skin, the taste of a morsel, or the odor of a rose.

While we are considering attention, it should be said that paying attention prepares the way for reasoning, imagining, and remembering as well as for perceiving. We may so direct our attention that thoughts of the past or future completely dominate us and we are practically unconscious of what is affecting our sense-organs. The genius in literature or scientific pursuits has been pictured as a man who is usually very absent-minded. In other words, his attention is accustomed to take a direction favoring a ready flow of thought and making him relatively unmindful of the commonplace objects and events about him to which most of us would be quite ready to give attention.

Attention is continually shifting. — Under ordinary conditions, as soon as a clear perception of an object has taken place, attention shifts in such a way as to bring about the perception of something else. That something else may be another object or, as in the case of the coin, another characteristic of the same object. When I look out of the window for some time, my attention shifts without effort from a tennis court to the brown autumn lawn, then to the white flagstaff in the center of the campus, then to the great towers of the university library, then to a roof just beneath me, and finally to the hissing steam in the power house, which I have been sensing all this time but not attending to and consequently not perceiving. When I look at the chair on the other side of my workroom, my attention just as naturally shifts from the leather seat to the back, then to the braces that hold the back in place, then to the legs, then to the braces that make them staunch, and so on, until I exhaust the possibilities of the chair or until something more striking compels me to turn my attention in a new direction.

Even when one is *concentrating*, as we say, his attention is continually shifting from one thing to another, but each thing attended to in that case is related to some one problem. The rapt attention of the art critic concentrating upon a fine picture is shifting rapidly from one feature of the work to another. The attention of the man concentrating upon how best to invest a sum of money is shifting from the thought of one security to that of another. The attention of the art critic, however, does not turn upon persons, objects, or occurrences that are unconnected with the picture upon which he is concentrating, nor does that of the investor turn upon thoughts unrelated to the question of how he is to invest his money. When we concentrate, our attention is as shifting as ever, but it shifts from one object or thought to other closely related objects or thoughts.

If one tries to prevent attention from shifting, he readily observes, in the difficulty of his task, the strength of the shifting tendency. If one keeps his eyes focussed upon an object, such as a letter or a simple geometrical form, for some length of time, that in itself is no guarantee that attention will remain upon the object. In all likelihood one will at least *think* of something besides the object being looked at.

Under certain conditions and with certain subjects the natural shifting of attention can be checked. A person who has sufficient self-control can concentrate for a long period upon a point of light, upon a monotonous sound, or upon images of sheep jumping a fence. But while attention can be maintained for some time upon a single object, the perception of that object cannot be held in a stationary condition. As soon as a perception is clear it tends to break down. If one stares at a familiar word and abstains from wandering thoughts, the word soon appears empty and devoid of meaning. Under more extreme conditions the

prolonged attention to a single simple object results in breaking down temporarily all mental activity. That is to say, the subject falls asleep. We have here an explanation of why persons afflicted with insomnia are advised to count imaginary sheep or in some other manner to restrict that natural shifting of the attention which is necessary for active experience. Hypnosis, which is a kind of sleep, is also induced by restricting the subject's attention.

There is little difficulty in understanding the importance of a shifting attention. The individual is at every moment surrounded by a multitude of objects and occurrences. His ability to keep adapted to his complicated surroundings is greatly facilitated by the fact that, just as soon as one element in his environment is fully appreciated, his attention almost invariably shifts to another.

Experience affects attention. — Our attention turns naturally and with little or no feeling of effort to any object that affects our senses vigorously. The bright light, the loud sound, the strong taste or odor is no sooner present than we turn our attention toward it. Such an object compels our attention even more powerfully if it comes suddenly and by itself. In the still of night a slight sound commands our attention, while, amid the many noises of the daylight hours, such a sound would be completely neglected. Ordinarily the sudden boom of a single cannon draws our full attention, but the soldier on the field of battle is likely to pay attention only to a cannon shot of unusual loudness.

We do not have to learn to give our attention to bright lights, loud sounds, strong odors, and the like. It seems to be born in us to pay attention to these things. We can, however, learn to disregard many objects which at first strongly attract our attention. I occasionally drive on a street over which are the tracks of an elevated electric railway. Now,

really there is no use paying attention to the trains which, every so often, go crashing along overhead. Yet, just because they make such a dreadful racket, I do pay attention to them. This is a handicap in driving; the street itself is a crowded place and deserves one's complete attention. But those who drive along that thoroughfare every day do not pay attention, as I do, to the trains on the overhead track. They have had sufficient experience to teach them to disregard everything but what is going on in the street itself. Doubtless there was a time when they gave attention to the noise of the elevated as naturally as I do now.

Odd and unfamiliar objects also tend to catch our attention. Many a man, surrounded by distracting duties and responsibilities, has fled to the country or to another city where he can think out some problem without the usual disturbances of everyday life. But having got there, he is very likely to be less able than ever to concentrate upon his own thoughts. There are too many odd and unfamiliar objects making demands upon his attention. The most sequestered country nook makes great demands upon attention unless we are accustomed to its peculiar sights and sounds. At one time, when I had a long Latin poem to translate, I tried to do the work while seated in a canoe drifting down a quiet river. It seemed as if one should be able to study more effectively in such peaceful surroundings than in a library in a city apartment where trolley cars were constantly rumbling past. That this was *not* the case is an easy guess from what has already been said. Although one naturally turns his attention toward noises, I had become accustomed to the sound of trolley cars and usually paid no attention to them. On the other hand, the gentle dipping of the canoe, the quiet lapping of the water, and the occasional calls of wild birds, while they had no vigorous effects

upon my senses, were strange enough to draw attention from the book. With experience I might have learned to neglect the sights and sounds of the river and to have studied there with an efficiency equal to or greater than that with which I studied at home. But that could never have been brought about without frequent efforts to work upon the river.

Experience trains us to pay attention to things we should naturally neglect, as well as to neglect many things, such as noises, toward which attention seems naturally drawn. The bird-lover suddenly comes to a halt in his walk through the woods and turns his attention to a little bunch of dry grass in a prong overhead. Most of us would pass by without stopping to perceive the nest. Not long ago a man was walking across a vacant lot in the upper part of New York City with an artist friend. As they were passing what to the casual glance was an unlovely pile of rusty cans, the artist stopped and looked at the dump with great care. Then he turned to his companion and remarked that the particular color scheme presented by the rusty cans, the bare ground, and some bits of rags and paper was very beautiful. An ordinary mortal would never have thought of paying any attention to the colors presented by a pile of cans in a vacant lot, but the artist had learned to pay attention to colors wherever they might appear.

Interests are habits of attention. — The naturalist who turns his attention to anything related to bird life is said to be *interested* in birds. The artist who pays attention to color, wherever he finds it, is said to be interested in color. From this we may conclude that to be interested in anything is to have acquired the habit of paying attention to it.

The acquisition of interests, or habits of attention, takes

place in much the same way that other habits are acquired. The young child turns his attention to food, bright lights, loud sounds, strange objects, moving objects, and that is about all. The powerful interests that people show in business, art, politics, science, are developed largely as a result of their experiences and training. It is not fair for a person to condemn any subject as uninteresting, simply because it does not compel *his* attention. He may not have had enough experience with it to develop an interest for it in himself. It is especially true of complicated things such as banking, symphonic music, chemistry, and international politics that only a great deal of experience can produce real interest in them.

C. Preparation for Movement

Attention prepares for perception and perception prepares for movement. — As he is approaching an intersecting street, a chauffeur catches a glimpse out of the corner of his eye of a fast-moving but indistinct object. Instantly his head turns toward the object and his eyes adjust themselves to get a clear view of it. He perceives that it is another machine and that it is displaying no signs of slowing down in its rush toward his street. His left foot throws out the clutch, his right foot presses on the service brake, and his right arm throws the emergency brake. The first thing that happened in this situation was that the chauffeur sensed a moving object which at the moment could not be perceived clearly. Next, he turned his attention to that object. We may guess that this involved more than turning the eyes. It probably involved a kind of sudden questioning what the object was. And, finally, after a clear perception of the situation had taken place, larger bodily movements, appropriate to the circumstances, put in their appearance. We

might make a scheme such as the following to represent the sequence of events.

Something is sensed → Something is attended to → Something is perceived → Overt movements take place

Unless our attention is directed toward an object, we cannot perceive it clearly. It is not true, however, that every time we pay attention to an object we perceive it. If the chauffeur were expert enough, he might throw on his brakes as soon as his attention was drawn to the other car. More than likely he would not perceive just what he was avoiding until after the movements were made. Indeed, it might be enough for him to catch a vague sidelong glance at the other car. In other words, appropriate movements might follow immediately the mere sensing of an object. This is distinctly the case among reflexes. The sensing of food in the throat is followed by swallowing without any processes of attention or perception intervening. We may well add the following schemes, then, to the one given above:

Something is sensed → Something is attended to → Overt movements take place

Something is sensed → Overt movements take place

As we have already hinted, the more accustomed one is to performing certain movements in the presence of certain objects (throwing on the brakes, for instance, to avoid striking another car), the less likely are attention and perception to occur. The mere sensing of the curbing at the street corner is enough to cause us to step over it. As a rule we do not have to attend to it and perceive it in order to act efficiently. But if a novel obstacle appears, such as a wire across the walk, we stop, pay attention, and seek to get

a clear perception of it. On that basis we are able to decide whether to stoop under it, step over it, or go around it.

Does perception always result in overt movement? — Percepts prepare for bodily movement. It does not follow from this, however, that every act of perception is followed immediately by a bodily movement. When I perceive that the long figure across my path is an old rope and not a snake, I may abstain from making any movement in response to it. When I perceive a word or phrase upon the printed page, I may simply turn my attention to the next word or phrase without making any overt movement in response to the former.

Still, the fact remains that mental activity of all kinds (perceiving, thinking, remembering, imagining, feeling) is chiefly important because of the ways in which it *can* affect movement. The perception that the figure on the path is a rope does not arouse important movement on my part, but if the act of perception had revealed a snake, important movements of attack or avoidance would have taken place. The word or phrase perceived upon a page may not now have an effect upon my movements, but at some later time it may have a very great effect. The railroad time card read today may have a very important effect upon my bodily movements tomorrow.

Summary of the Chapter

1. Perception, which is the knowing of objects and occurrences presented to our senses, is going on during most of our waking life. This practically continuous perceiving is not made up of disconnected acts of perception. One percept fades gradually into the next.

2. In perception there is an active interpretation of what is presented to sense. This interpretation does more than

give meaning to sensory data. It may even alter the apparent character of those sensory data.

3. Perceptual reactions are habits acquired as a result of definite experiences. This is shown by the fact that what people perceive in a given situation depends largely upon their past life and training.

4. Illusions also show the close dependence of perception upon past experience. Some of these illusions illustrate the effects of experiences peculiar to certain individuals, while others illustrate the effects of universal experiences. Illusions of this latter type are so constant in character that they can be relied upon in the theater and in drawing and painting.

5. Perception is markedly affected by what one expects to perceive. A state of expectation may make one more susceptible to an illusion. It may also make one more likely to perceive both accurately and promptly.

6. It is clear that an act of perception is influenced by past experience and expectancy. Nevertheless, at the actual time of perceiving, the perceiver is usually unaware of the past upon which his interpretation is based and unaware also of any definite expectation. Only when perception is difficult do all the factors entering into it tend to become conscious.

7. How much we can take in during a single act of perception depends upon the manner in which the objects present to sense are organized. If they are organized into larger wholes of a sort with which we have had some dealings, our perception has a large scope. But if the objects are not organized in a familiar manner, the scope of perception becomes much restricted.

8. Attention is a state of preparation for perception (or for thought or movement). It consists in turning the head,

focussing the eyes, and otherwise securing a maximum effect upon the senses. It also consists in such mental preparation as a state of expectancy toward what one is going to perceive.

9. Attention is a constantly shifting process. Even when we are concentrating, attention shifts rapidly from one to another aspect of the matter to which we are attending. If the shifting of attention is sufficiently checked, mental activity becomes so disorganized that sleep or some such similar state as hypnosis occurs. When the complexity of events within us and around us is considered, the advantage of this shifting of attention is evident.

10. Through experience we come to pay attention to many things which previously would have been neglected and also to neglect many things which previously would have commanded our attention. We are interested in matters to the degree to which we have formed habits of paying attention to them.

11. A typical sequence of events is this: something affects our senses, we pay attention to it, we perceive it, and we react to it with overt movements. This sequence is, however, frequently short-circuited. Overt reaction may follow immediately upon sensing without the intervention of attention and perception. Or attention may remain and only perception be absent from the sequence.

12. Perception typically prepares for overt movement. Often, though, this movement is considerably delayed in appearing and often no movement of any special consequence develops out of a particular perception.

PROBLEMS

1. Make a list of ten perceptions which you have had during the past few hours.

2. The first few days spent in a new place brings about a marked change

in the way the streets, the houses, and the people look to you. Why is this the case?

3. Upon whom would you expect the skyscrapers of New York to make the greater impression: upon a savage who had never seen buildings larger than crude huts, or upon a person who had lived all his life in a small town and who was familiar with office buildings, but not with very large ones? Why?

4. Describe an illusion of your own which was caused by some experience more or less peculiar to yourself.

5. Why is it that everyone gets an illusion of movement while looking at motion pictures?

6. It frequently takes some little time before one is first able to perceive the children in Figure 28. But after they have once been perceived, they are readily perceived on later occasions. Why is this the case?

7. There are expert automobile mechanics who can perceive in the sound made by a motor whether anything is wrong and, if so, what. As often as not, such men are unable to explain what is involved in these perceptions. How do you account for this?

8. There seems to be much greater confusion in the crowded streets of a strange city than in the equally crowded streets with which one is familiar. What underlies this illusion?

9. What are some of the signs that an audience is paying close attention to a speaker? What are some of the signs of inattention?

10. When we speak of a person as being inattentive, do we mean that he has actually ceased paying attention or merely that he has changed the direction of his attention?

11. Why is it that the attention of children seems to shift more than that of adults?

12. What are some of the things which you have learned to pay attention to during the past year? How were these new habits of attention acquired?

13. Does attention come first? Does interest come first? Or do they both come hand in hand? Why?

14. State a case in which there is an advantage in having overt movement follow sensing immediately and without intervention of attention and perception. Under what conditions is a short-circuit of this type a source of danger?

REFERENCES FOR FURTHER STUDY

Binet, *The Psychology of Reasoning* (3d ed. tr. by Whyte), pp. 4–8; or *Readings in General Psychology*, Ch. XI, Selection 1-A, p. 239 ff.

Witmer, *Analytical Psychology*, pp. 1–6; or *Readings*, Ch. XI, Selection 1-B, p. 241 ff.

Seashore, *Elementary Experiments in Psychology*, pp. 146–148; or *Readings*, Ch. XI, Selection 1-C, p. 245 f.

Stratton, *Experimental Psychology and Its Bearing Upon Culture*, pp. 115–121; or *Readings*, Ch. XI, Selection 2, p. 247 ff.

Störring, *Mental Pathology in Its Relation to Normal Psychology* (tr. by Loveday), pp. 19–21; or *Readings*, Ch. XI, Selection 3, p. 250 f.

Buswell, in *Readings in General Psychology*, Ch. XI, Selection 4, p. 251 ff.

Pillsbury, *Attention*, pp. 1–11; or *Readings*, Ch. X, Selection 1, p. 226 ff.

Pillsbury, *Attention*, pp. 64–71; or *Readings*, Ch. X, Selections 2 and 3, p. 228 ff.

Ribot, *The Psychology of Attention* (6th ed. tr.) pp. 11–19; or *Readings*, Ch. X, Selection 4, p. 232 ff.

Ribot, *The Psychology of Attention*, pp. 29–34; or *Readings*, Ch. X, Selection 5, p. 235 ff.

CHAPTER VIII

THE VARIETIES OF PERCEPTION

A. Perceptions of Simple Sense Qualities
B. Perceptions of Several Senses

Questions to Keep in Mind while Reading this Chapter

1. What information can be secured through a single sense?
2. What are examples of information depending upon the co-operative activity of a number of senses?

A. Perceptions of Simple Sense Qualities

Perceptions may be classified according to the senses. — Perceptions, as we have seen, are acts of knowing in which we interpret immediately, and without any extended thinking, that which is presented to our senses. Now there are a number of different ways in which we might classify our perceptions, but perhaps the most fundamental classification is in terms of the senses involved. Thus there are visual perceptions, auditory perceptions, cutaneous perceptions, and so on. And within each of the senses further distinctions can be made. Our visual perceptions may be perceptions of white, of black, of red, of blue. Our auditory perceptions may be of noise or tone, of a high tone or a low tone.

When we have enumerated our perceptions according to the senses affected, we have marked off the limits of perceptual experience. There are no perceptions for which there are no sense-organs. This does not mean, however, that every perception will be included in our list. Many of our perceptions depend immediately or remotely upon

the operation of more than one sense or upon the operation of the same sense in more than one way. The perception of a lemon may seem to be purely a matter of vision, but in the act of perception there may be contained a realization that the lemon is sour. This element depends upon our having previously tasted a lemon as well as upon our having seen one. But we cannot undertake the task of listing every one of these complex perceptions. To do so would require more knowledge than anyone possesses, and the list would be too long to be useful. We shall, therefore, content ourselves with an account of perception as it is found in the various senses, and to this we shall add a few words about some of the more general cases of complex perception.

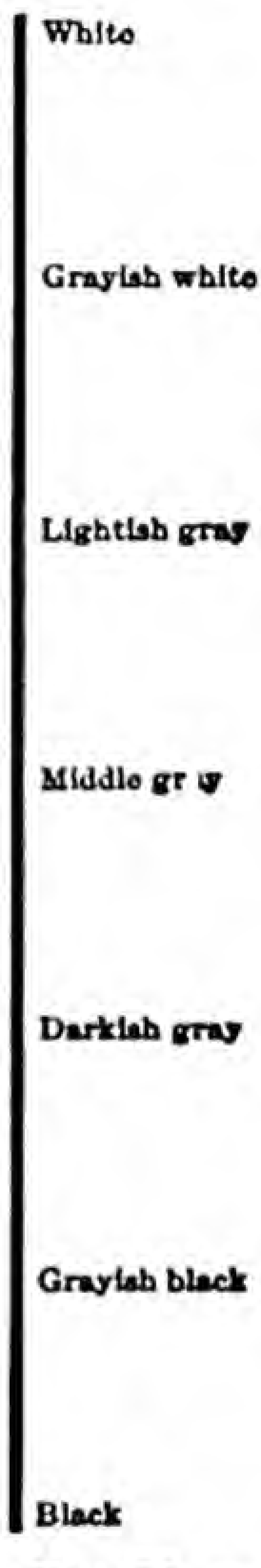


FIG. 30. — THE ACHROMATIC SERIES

Brightness and color. — By means of perception through the eye we become acquainted with two fundamental sets of qualities: (1) achromatic qualities, and (2) chromatic qualities. We think of the achromatic qualities as lying along such a straight line as that of Figure 30 which runs from the whitest possible white through medium gray to the blackest possible black. The transitions along this line are very gradual; in fact they represent transitions that are just barely distinguishable. We can think of the chromatic qualities as arranged in an approximate circle after the fashion of Figure 31.[1] The transitions

[1]There is a great deal of disagreement as to whether the chromatic qualities ought to be represented by a figure approximately a triangle, a square, or by a circle. However, that need not trouble us. The essential fact is that the series of chromatic qualities returns upon itself. This fact is represented equally well by triangle, square, or circle.

in the chromatic series (Fig. 31), like those in the achromatic series, represent just distinguishable differences. Perhaps the most striking difference between the two series is that the color series returns upon itself, while the white-gray-black series does not. Start at red and go through purple, violet, blue, green, yellow, and orange, and back you come to red again. Similarly, if you start from yellow, green, blue, violet, or purple, and move in either direction you will gradually make your way back to the color from which you start. This is not true for the achromatic series. If you start from any shade of gray and move in one direction you come to white, and that is the end of the series. Move in the other direction and you come to black, and that is the other end of the series. From black or white movement is possible in only one direction.

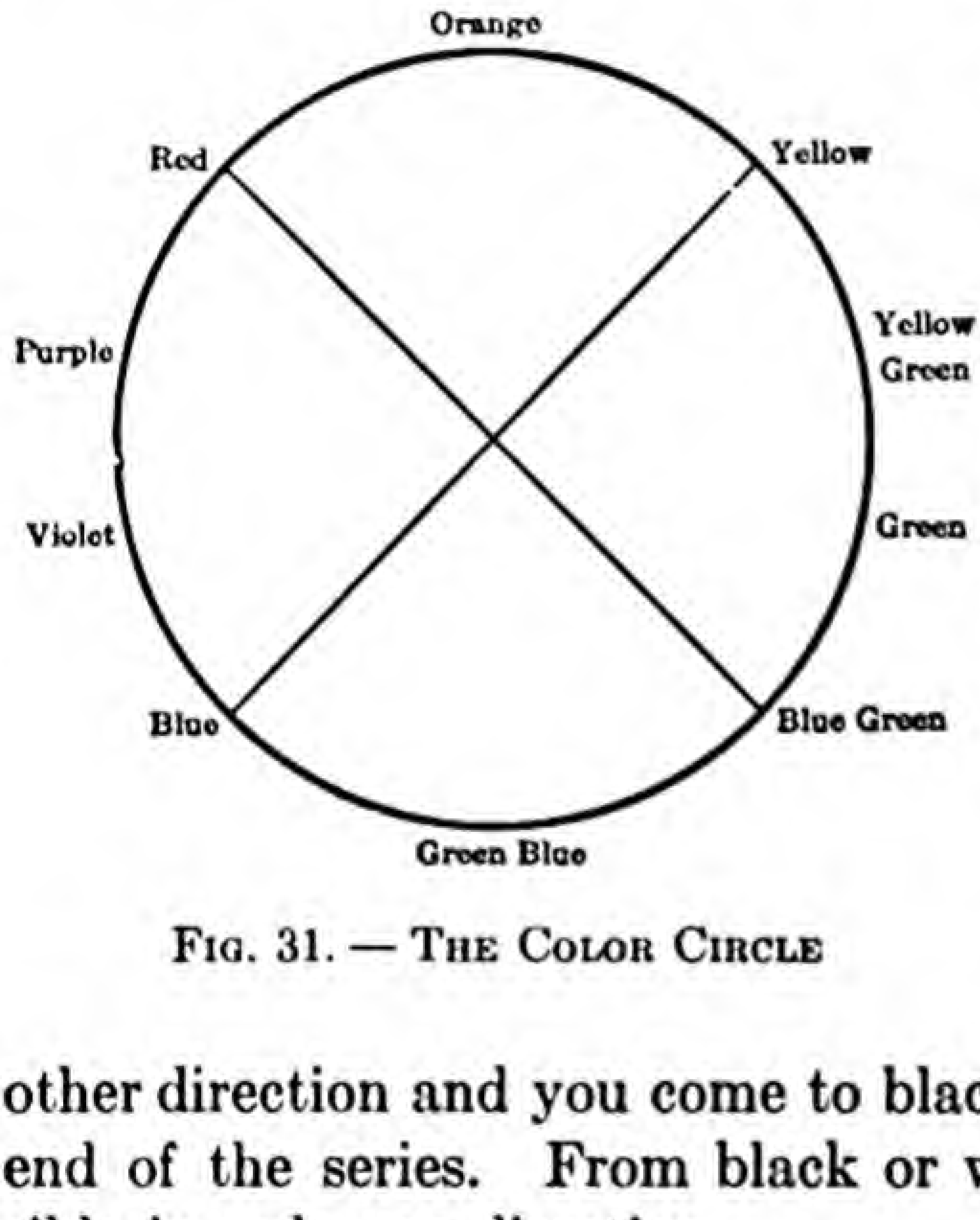


Fig. 31. — The Color Circle

The color spindle. — There are many visual qualities which do not find a place either in the line representing the whites, grays, and blacks, or on the circumference of the circle representing the colors. Where, for instance, should we look for pink in either of those series? Naturally we should look for it in the neighborhood of red in the color circle, but it is not there. If we move from red toward orange we fail to locate pink. If we move in the other direction from

red, we run into purple and again we fail to locate pink, because certainly pink is not between red and purple. *Pink is red with light gray or white in it and must lie, therefore, somewhere between red and white or light gray.* But red is a chromatic quality, while white and gray are achromatic. Evidently it is necessary to show how the two series, chromatic and achromatic, are related. This is done in the *color spindle* of Figure 32. The greatest length of the spindle is the achromatic line already described and the greatest circumference is the chromatic circle.

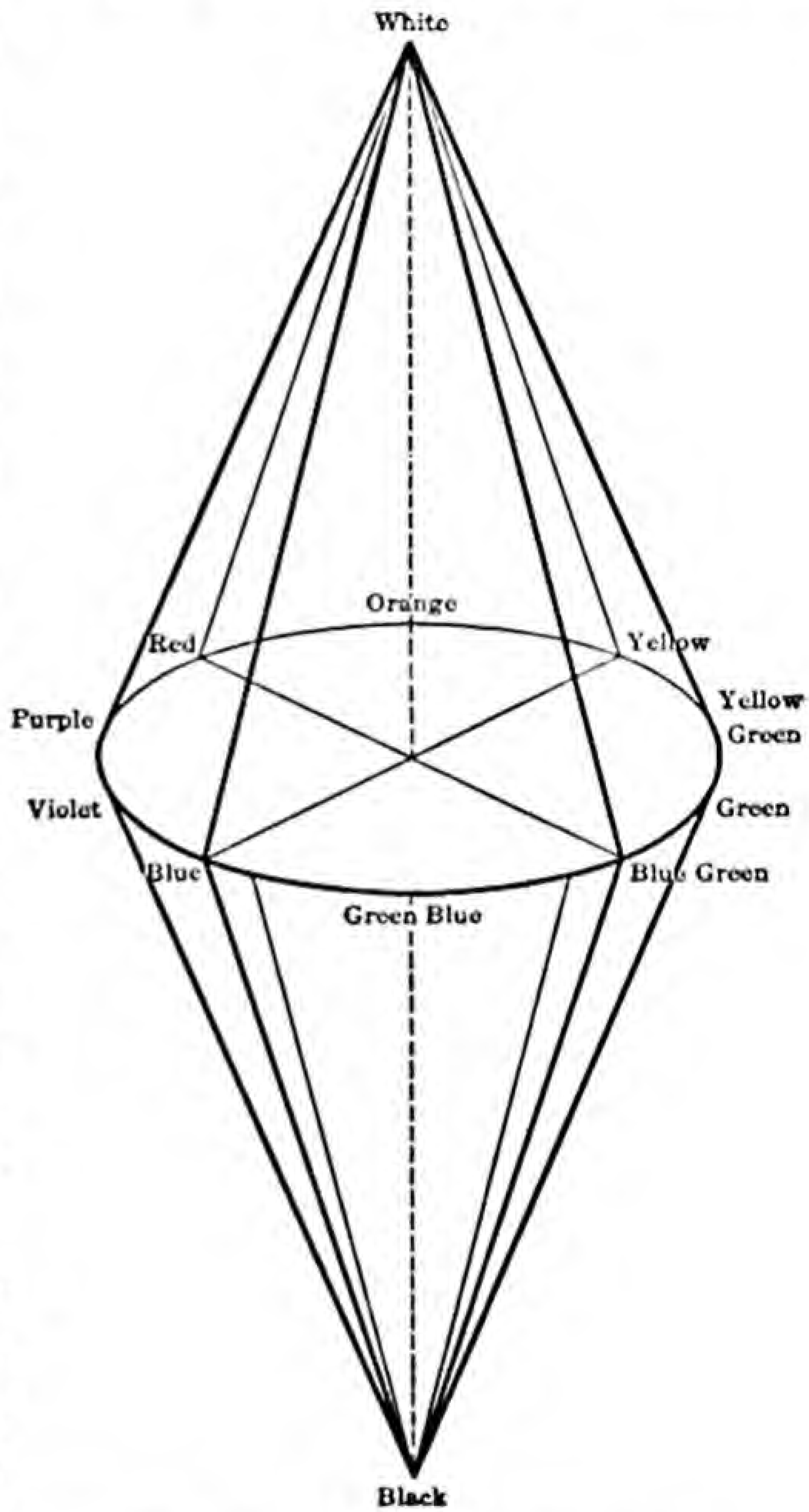


Fig. 32. — The Color Spindle

Within this color spindle are represented all of the known visual qualities. Its nature will be clearer if we delve into it and make some explorations. Let us start with red, which is located on one side of the spindle at its thickest part. If we move directly into the center of

the spindle, the red fades out and grows more and more gray. If we move up toward the top of the spindle, the red grows whiter and whiter. (It is along this line that we find pink.) If we move from red down toward the lower point of the spindle, the red grows blacker and blacker. A continuation of such exploration would reveal many thousands of visual qualities.

Skill in color perception depends both upon heredity and personal experience. — Although color blindness is sometimes the result of illness or of the excessive use of certain drugs, in by far the majority of cases it is an inherited defect in the sensitivity of the eyes and is incurable. In rare cases there is a complete inability to distinguish colors. If one color is brighter than another the two can be distinguished on the basis of brightness, but if such colors as red, yellow, green, and blue have the same brightness, they all look alike. In most cases of color blindness, however, only certain colors are confused. One of the most frequent and striking errors of the color blind is the mistaking of red for green and vice versa. The following, taken from Dr. Jeffries' book on color blindness, is illustrative:

> If railings were painted red, I could not distinguish them from the grass. The grass in full verdure appears to me what other people call red; and the fruit on the trees, when red, I cannot distinguish from the leaves, unless when I am near it. A cucumber and a boiled lobster I should call the same color, making allowance for the variety of shade to be found in both; and a leek in luxuriance of growth is to me more like a stick of sealing-wax than anything I can compare it with.[1]

We noted in the paragraph before the last that the color blind are able to perceive differences in brightness —

[1]*Color Blindness*, p. 45.

achromatic differences. It is seldom that objects differing in color or chromatic quality do not also differ in brightness. For this reason the color blind are able to get along better than one would suppose, and often very marked cases go through life without knowing the real nature of their difficulty. One color-blind man knew fresh-cut grass from bleached grass only because the former looked more brilliant to him. Having distinguished the fresh-cut from the bleached grass, he would call one green and the other yellow, simply because other people applied these names to them. To him the difference was solely one of brilliance. Other differences, too, help the color blind to hide their weakness. The man just referred to made the following statement about how he identified various kinds of corn:

> At home we raised three kinds of corn: red, yellow, and white. Red was red, white was smooth, and yellow was rough, and it was years before I could convince myself that a thing could be yellow, and not rough.

A paper hanger was recently putting a plain green paper on the walls of a room, and he ran out of paper. Taking a sample he went back to the shop. No one was there, so he matched the sample to his own satisfaction and took two rolls to finish his job. The next day the owner of the house came into the shop furious because one corner of the green room had been papered red. Up to this time the paper hanger had not suspected that his color vision was unlike that of other people. Since many color-blind individuals do not reveal their weakness even to themselves, it is important to have some test more rigorous than that supplied by color experiences of everyday life. A railroad engineer, for example, would be a menace to safety if his color vision were imperfect, and a painter with the same weakness would hardly be reliable. A well-known scientific test for color

blindness is the Holmgren wool test. The subject of this test matches skeins of wool of varying shade and color. He is directed to make the matches entirely on a color basis and to disregard differences of shade. Color blindness which has never been suspected is often detected by this test.

So far, we have spoken of inherited color blindness. A certain amount of inefficiency in dealing with colors is due simply to lack of practice. Errors are made in naming colors by individuals who can accurately distinguish between colors if they are placed side by side. Purple is frequently called "violet," orange "yellow," and certain greens "blue" by persons whose eyes are normally sensitive to colors. The difficulty here lies in the fact that these persons have had insufficient practice in calling colors by their correct names. Women, because of their customary preoccupation with ribbons, dress goods, and the like, are, as a group, superior to men in naming colors accurately. It is probable, however, that most men, with the benefit of similar experience, could increase to a marked degree their ability to name colors.

Ether vibrations are the basis of visual qualities. — Light passes through space in the form of waves or vibrations of what is called the ether. We do not know a great deal about this ether,[1] but it is convenient to believe that such a thing exists, because, otherwise, we should not know how to account for the fact that light passes through space which is unoccupied by any known substance. You can see that it would be difficult to imagine how waves or vibrations could occur in nothing at all.

These ether vibrations are unbelievably rapid. Those which are capable of affecting the human eye range from about 417 trillion per second to about 755 trillion per second. And their length is unbelievably short. The slowest vibra-

[1] This is not the kind of ether used as an anaesthetic.

tions or waves which affect the eye are about 760-millionths of a millimeter in length and the fastest about 390-millionths of a millimeter. There are ether vibrations above and below this range, but they do not play a part in vision.

Light from the sun and from many artificial sources contains vibrations of various rates and lengths. When such mixed light affects the eye it gives rise to achromatic qualities. Whether they be white, gray, or black depends upon the strength or energy of the light. If the light is very strong, white is seen. If it is less strong, gray is seen. And if it is very weak, black is seen.

When we see a rainbow it is because small drops of moisture in the air have so acted upon the sunlight as to break it up into the different kinds of light of which it is composed. The short-wave light and the long-wave light are separated, and different colors are seen, corresponding roughly to the wave lengths of the light. If sunlight is passed through a glass prism, all of the colors of the rainbow are visible. The following table gives an idea of the wave lengths corresponding to the various colors. There is no particular reason to memorize the table.

Wave length (millionths of a millimeter)	*Color*
760–646	Red
647–587	Orange
588–549	Yellow
550–491	Green
492–454	Blue
455–390	Violet

You may notice that purple is not given here. That is because purple is obtained only as a result of mixing the long waves that produce red and the shorter waves that produce blue. There is no one length of wave capable of producing purple.

While red, orange, yellow, and the other colors given in the table can be produced by a single type of wave, they also

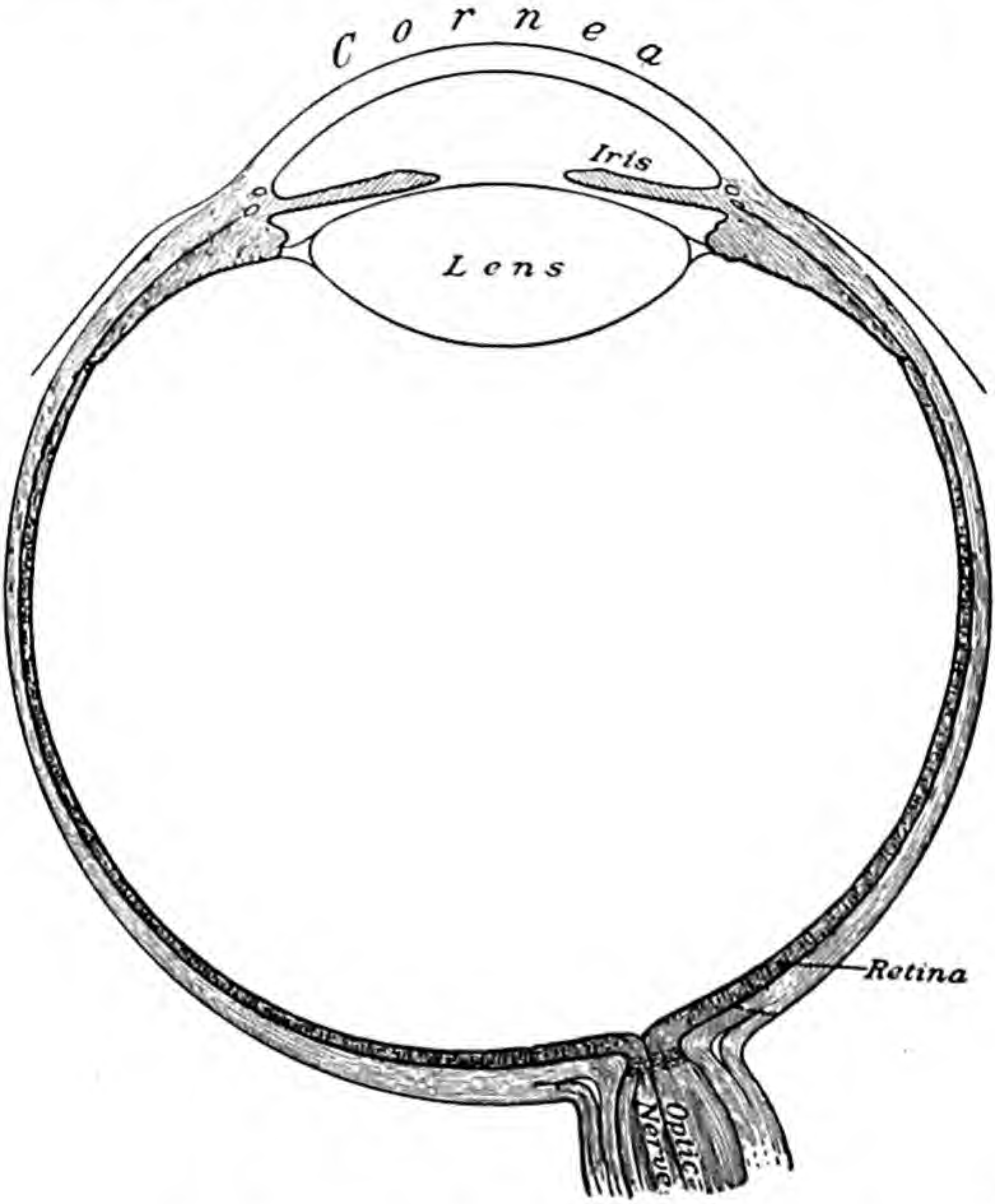


FIG. 33. — HORIZONTAL SECTION OF THE LEFT EYE

can be produced by mixtures of longer and shorter waves. Thus orange can be obtained by mixing light which produces red with light which produces yellow, and bluish green by

mixing light which produces green with light which produces blue.

The human eye and its parts. — In Figure 33 we have a cross-section view of the human eye. Light, entering the eye, first passes through the bulging front surface. This is called the *cornea*. But not all the light that penetrates the cornea gets into the eyeball itself, because back of the cornea

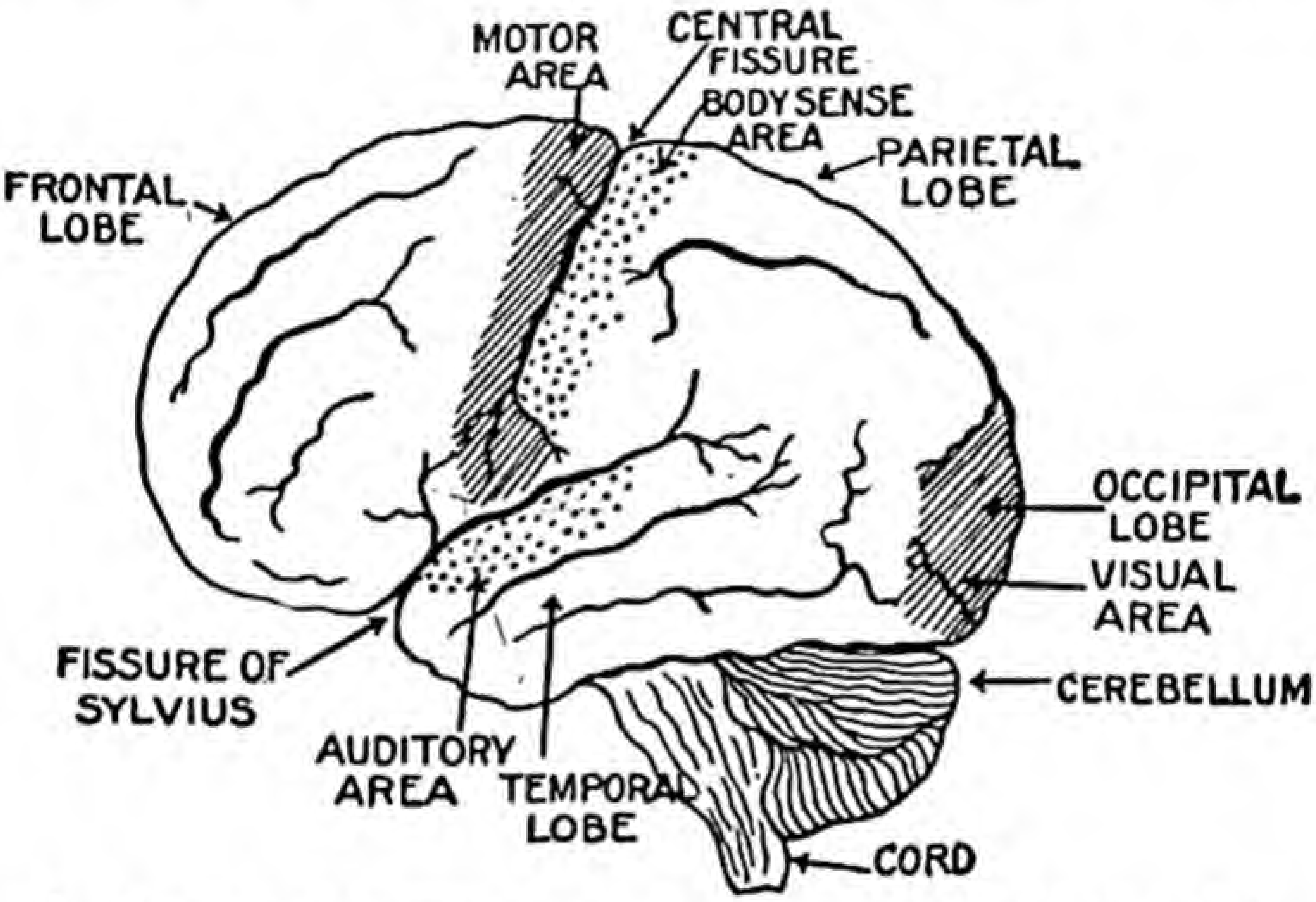


FIG. 34. — SIDE VIEW OF THE LEFT HEMISPHERE OF THE BRAIN

This drawing is not intended to be an accurate picture of the brain, but to show the important fissures and lobes in the primary visual, auditory, and body sense areas. (From Gates, *Elementary Psychology*, The Macmillan Company.)

is a membrane, the *iris* (it is the colored portion of the eye), which allows only such light to pass through as can be taken care of by a little hole in its center. This hole is called the *pupil*. The pupil is small in a brilliantly lighted room, but in a dim light it enlarges and permits more light to enter the eye. Behind the iris is a *lens* which is so adjustable that it can under normal conditions bring the entering light to a good focus on the back, inner surface of the eye. When the

eyeball is too short or too long, when the lens fails to adjust itself readily, or when the surface of the cornea or lens is uneven, it is necessary to help the eye focus by means of glasses.

The back, inner surface of the eyeball is called the *retina.* The optic nerve, which enters at the back of the eye, spreads out in an intricate network throughout this retina. The nerve fibers have at their ends tiny sense-organs, called *rods* and *cones,* which convert the light that is focussed on them

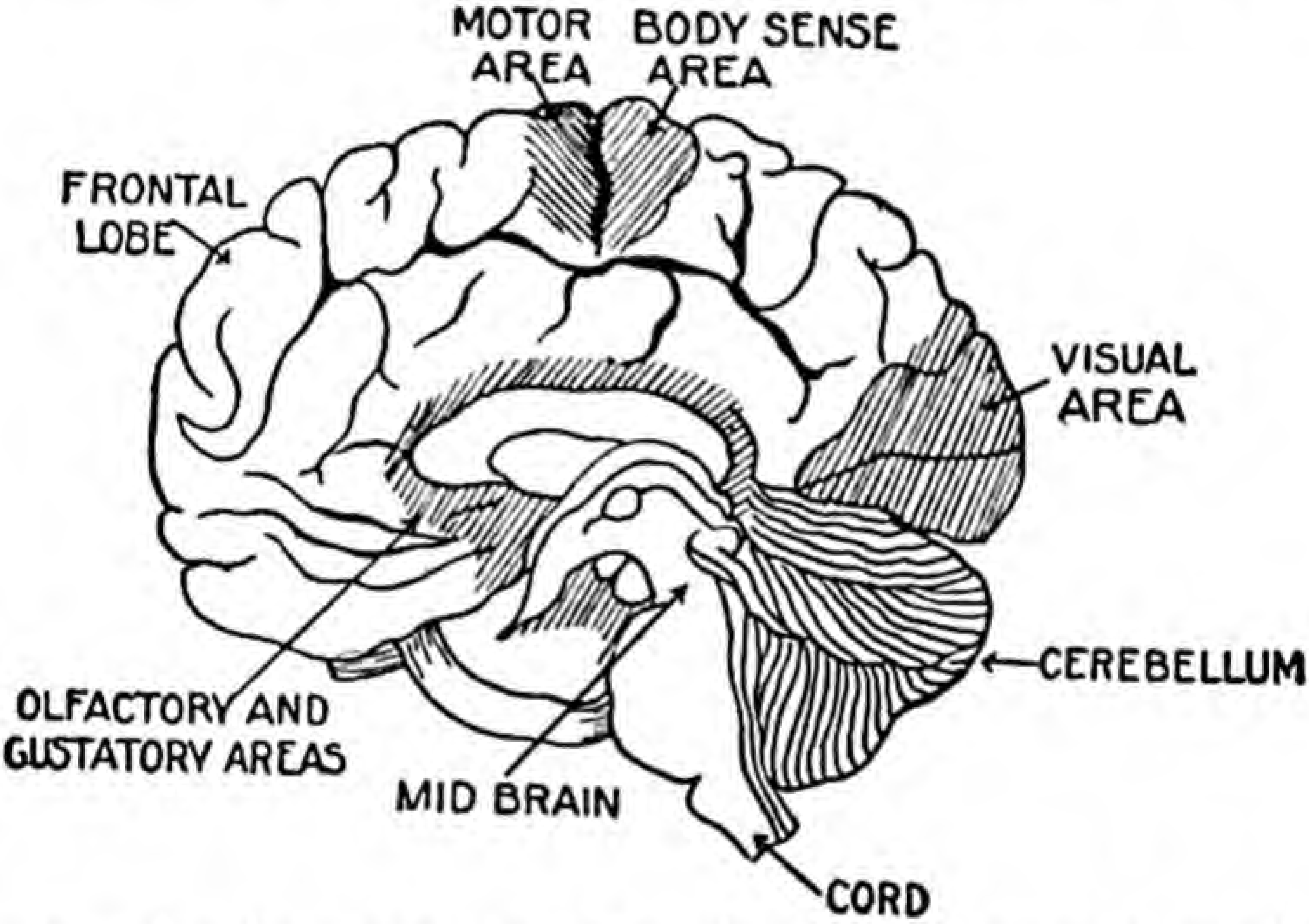


FIG. 35. — THE INNER SURFACE OF THE RIGHT HEMISPHERE OF THE BRAIN
This drawing, also very schematic, shows the parts concealed in Figure 34. From Gates, *Elementary Psychology,* The Macmillan Company.)

into nerve activity. The longest of these sense-organs are about $\frac{1}{350}$ of an inch in length, and the thickest are about $\frac{1}{10000}$ of an inch in diameter.

The optic nerve carries the nerve activity produced by light at the rods and cones to the brain. This activity reaches the outer surface or *cortex* of the brain in a region called the visual area (see Fig. 34). From there it finally goes to other brain centers and thence out to the muscles.

Noise and tone. — The fundamental sets of visual qualities are the achromatic and the chromatic. Similarly there are two fundamental sets of qualities perceived by means of the ear. They are (1) noises and (2) tones. Noises are either very short in duration to the point of being abrupt or, if longer in duration, they have a roughness and irregularity about them. Tones must last for a certain length of time or they are not tones, but noises. A tone has a smoothness about it that endures even though its loudness waxes and wanes. In everyday life tones and noises are very much mixed together. The best violinist cannot eliminate all noise from his instrument, and even the rumble of a distant cannon has in it an element of tone.

No one knows how many different noises can be perceived. It is difficult even to classify them in any satisfactory fashion. Some psychologists adopt the practice of dividing noises into two large groups or classes, the explosive and continuative. "For the former," says Professor Titchener, "we have such words as crack, pop, snap; for the latter, such words as hiss, sputter, rumble."[1] Although pitch, that is, highness and lowness, is, as we shall see in a moment, primarily a characteristic of tones, it is never absent in noise. It is possible therefore to arrange different noises according to their pitch. The noise of a large cannon, a steamboat whistle, or a wagon crossing a wooden bridge is decidedly low in pitch, while that of hissing steam, a squeaky spring, or the snap of a cap pistol is decidedly high.

The perception of tone is a much more definite matter. First, and most obviously, the tones we are capable of perceiving can be classified according to pitch. There are low tones, medium tones, and high tones. We can go farther than that and say that there are something over ten thousand

[1] *Textbook*, p. 95 (Macmillan).

different tones which can be distinguished on the basis of pitch. That is to say, in passing up the scale from the lowest tone that can be perceived to the highest tone that can be perceived, there can be found over ten thousand perceptibly different pitches. Most of these tones are heard but rarely. Our tonal perceptions are largely confined to the world of music, and music makes use of only about one hundred pitches from the middle range of hearing, that is, pitches that are neither extremely high nor extremely low.

We have no difficulty in distinguishing between tones of identical pitch, let us say middle *c*, when they are sounded on the piano and on a horn. Neither have we any difficulty in distinguishing tones of identical pitch if they are sung by two voices. How is it possible to make such distinctions when pitch remains the same? It might be suggested that the tones differ in loudness and that that is how we tell them apart. A very little experimentation, however, will demonstrate that this explanation is not the correct one. The middle *c* of the piano may be either louder or softer than that of the horn and still we shall have no difficulty in knowing which is which. The same is true of two voices. The real explanation is not quite so simple. It so happens that each of the actual tones we deal with in music and in everyday life has, itself, more than one pitch. When middle *c* is sounded on the piano, the simple middle *c* pitch is most clearly heard, but there are other higher pitches that go along with it. When middle *c* is sounded on a horn, the same simple middle *c* pitch is most clearly heard, but the higher pitches that go along with it are not the same as in the case of the piano. This kind of difference which makes possible the distinction between piano and horn, or between one voice and another, is called a difference in *timbre*.

Some persons discriminate pitch more accurately than others. — Some persons are extremely efficient in perceiving pitch, others are only fair, and still others are extremely poor at it. Ability to discriminate between one pitch and another seems to be largely a matter of inheritance. It seems to depend upon the sensitivity of the ear itself rather than upon special experience with tones. Training will increase one's ability to discriminate between tones of different pitch, but usually not to any great extent. The testing of tonal discrimination is a relatively simple task. The tests are carried out by means of tuning forks. Some of the forks are similar in pitch, and in other cases the differences are marked. When two forks are sounded in succession, the subject of the test has to tell whether the second tone was higher or lower than the first. In this way it can soon be discovered just how different in pitch two tones have to be before he can discriminate between them.

Before devoting valuable time to the serious study of music, it is wise to have tested one's capacity to perceive tones. With relatively poor tonal discrimination it is possible to enjoy music, because loudness and rhythm as well as pitch are involved. But it is practically impossible to attain great skill as a singer or instrumental performer without good tonal discrimination.

Hearing depends upon vibrations. — In order that an object give off a sound, it must be in a state of vibration. When one draws a bow across the string of a violin, the string is set into vibration; when one blows upon a trumpet, the column of air within the instrument is set into vibration; and when one sings or speaks there are vibrations in the vocal organs of the throat. These vibrations are imparted to the air around the source of the sound and spread out as air waves or vibrations. When the air waves

come into contact with the ear of a listener, they arouse in him the perception of sound.

The waves that give rise to hearing are very much slower than those ether waves upon which vision depends. They range from about 25 to 30,000 a second. They are also very much longer than ether waves. The longest waves have a length of about forty feet and the shortest of about half an inch.

Just as color depends upon the length or rate of the ether waves, so the pitch of a sound depends upon the length or rate of the air waves. *The longer and slower the waves or vibrations of the air, the lower is the pitch of the sound we hear; and the shorter and more rapid the air vibrations, the higher the pitch.* The lowest tone on the grand piano has a vibration rate of 26⅔ a second, and the highest tone a vibration rate of 4,096 a second.

The human ear and its parts. — Air waves coming to the ear enter first into the *auditory canal* (*A*) (see *A* in Fig. 36). They pass through this canal to the ear drum or, as it is technically called, the *tympanum* (*B*). The ear drum itself is then set into vibration. Now, attached to the ear drum is a little chain of bones, or *ossicles*, which stretches across the small open space (*C*) called the *cavity of the tympanum*. Vibrations of the ear drum are at once transmitted to this little chain of bones and are thus conveyed across the cavity. Opening off the far side of the cavity and connected with the far end of the chain of bones is a small canal (*F*), the *cochlea*, which curves around in the bone of the skull like a snail shell. In Figure 36 we have an interior view of it, and in Figure 37 we have an exterior view of it. Vibrations which have crossed the chain of bones are transmitted to a fluid contained in the cochlea. Within the cochlea are cells especially sensitive to vibrations, and these are affected by the vibrations in the fluid of the cochlea.

The Eustachian tube (*D*, Fig. 36) leads from the cavity of the tympanum down into the throat. Although not as directly involved in hearing as some of the other parts of the ear, it is, nevertheless, of great importance. Its purpose is to keep the same degree of air pressure on both sides of the ear drum. If you have ever descended from one of the

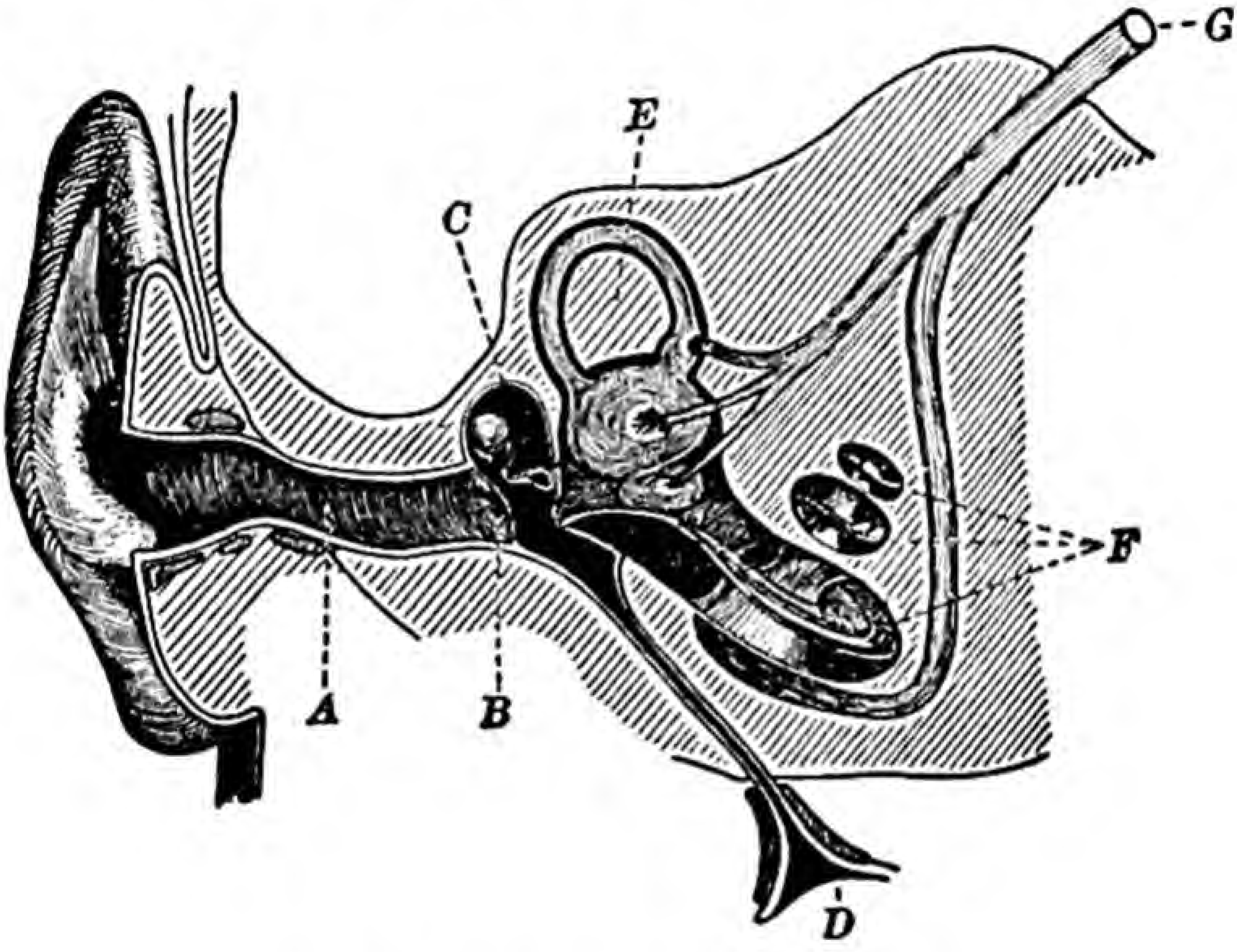


FIG. 36. — DIAGRAM OF THE EAR

upper floors of a skyscraper in a fast, express elevator, you have probably noticed a feeling of pressure in the ears. This is due to the fact that the pressure of the air at a low altitude is very much greater than that at a high altitude. When you make a descent in an elevator, the pressure of the outside air which is bearing in upon the ear drum is changing more rapidly than that of the air within the cavity of the ear. But a few vigorous swallows will force air of greater pressure

through the Eustachian tube, and then the pressure on both sides of the ear drum will be equalized and you will not be conscious of any pressure at all.

The semi-circular canals (*A*, *B*, and *C*, Fig. 36) are sense-organs, but not for hearing. We shall speak of their purpose a little later.

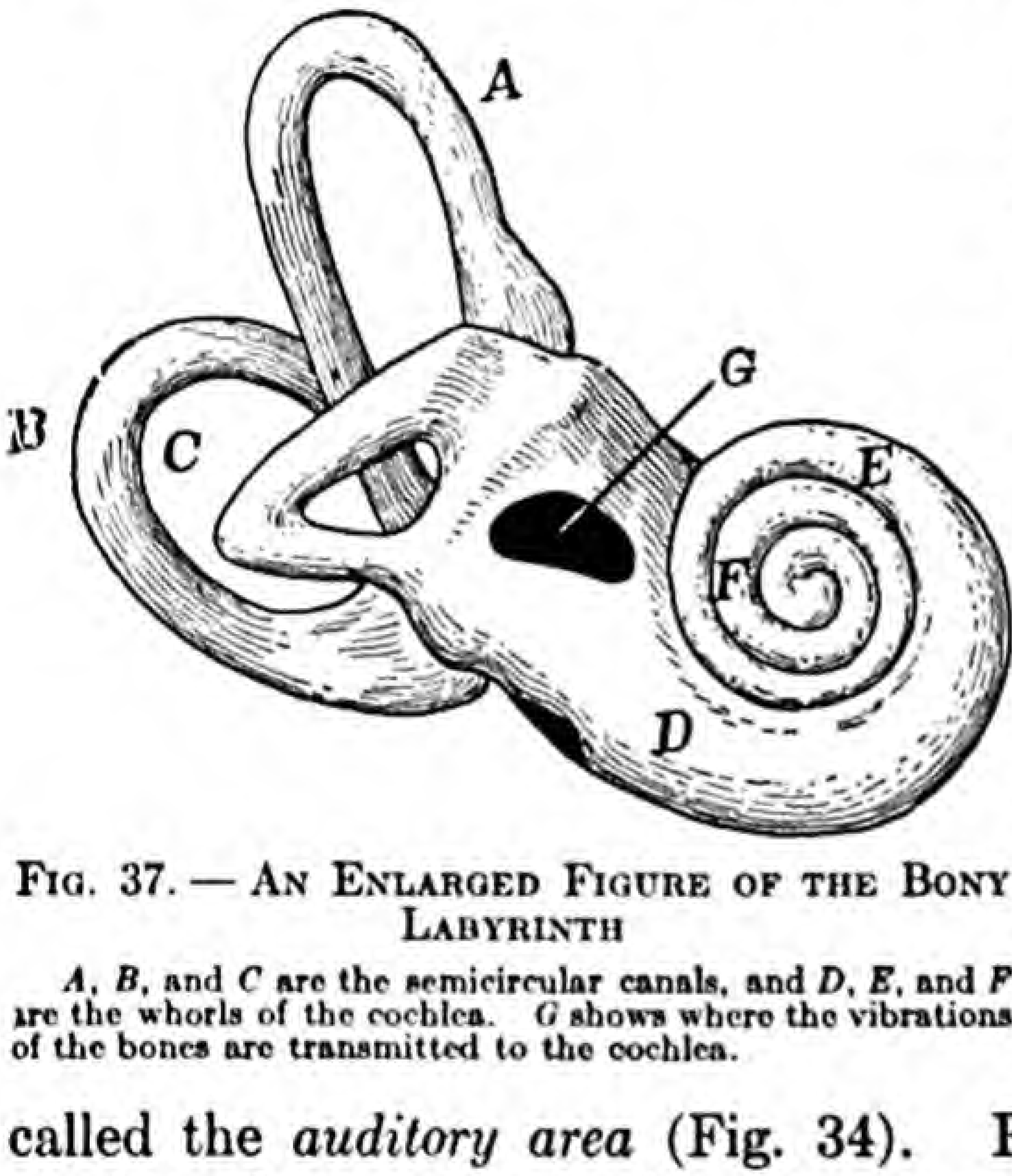


Fig. 37. — An Enlarged Figure of the Bony Labyrinth

A, *B*, and *C* are the semicircular canals, and *D*, *E*, and *F* are the whorls of the cochlea. *G* shows where the vibrations of the bones are transmitted to the cochlea.

When the sensitive cells of the cochlea are set into vibration (*G*, Fig. 37), the auditory nerve becomes active and nerve impulses are conducted along it to the brain. The nerve impulses set up at the sensitive cells of the cochlea reach the surface or cortex of the brain in a region called the *auditory area* (Fig. 34). From there they are conducted to other brain centers, and finally out to the muscles.

The sense of smell. — While the odors of many flowers, foods, chemicals, and so on, can be accurately identified, scientists have so far been unable to determine how many odors can be perceived. They have also failed to organize odors into a satisfactory system comparable to those of tone and color. Recently the suggestion has been made that there are six elementary types of odors. These are (1) spicy, (2) flowery, (3) fruity, (4) resinous, (5) foul, and (6) scorched.

One of the most striking facts about the perception of odor is that it is usually accompanied by a strong feeling of liking or disliking. Very few odors are indifferent; they are either pleasing or displeasing. This has led some to say that there are two kinds of odors, the pleasant and the unpleasant. It must be admitted that there are very great differences, however, even among pleasant odors. Carnations and frying ham are both pleasant to most people, but they are quite unlike. Another fact of importance is that the same odor may be pleasant when present to a weak or moderate degree and unpleasant when present to a strong degree. The same perfumery, which in moderate amounts is pleasing, may, in large quantities, be obnoxious.

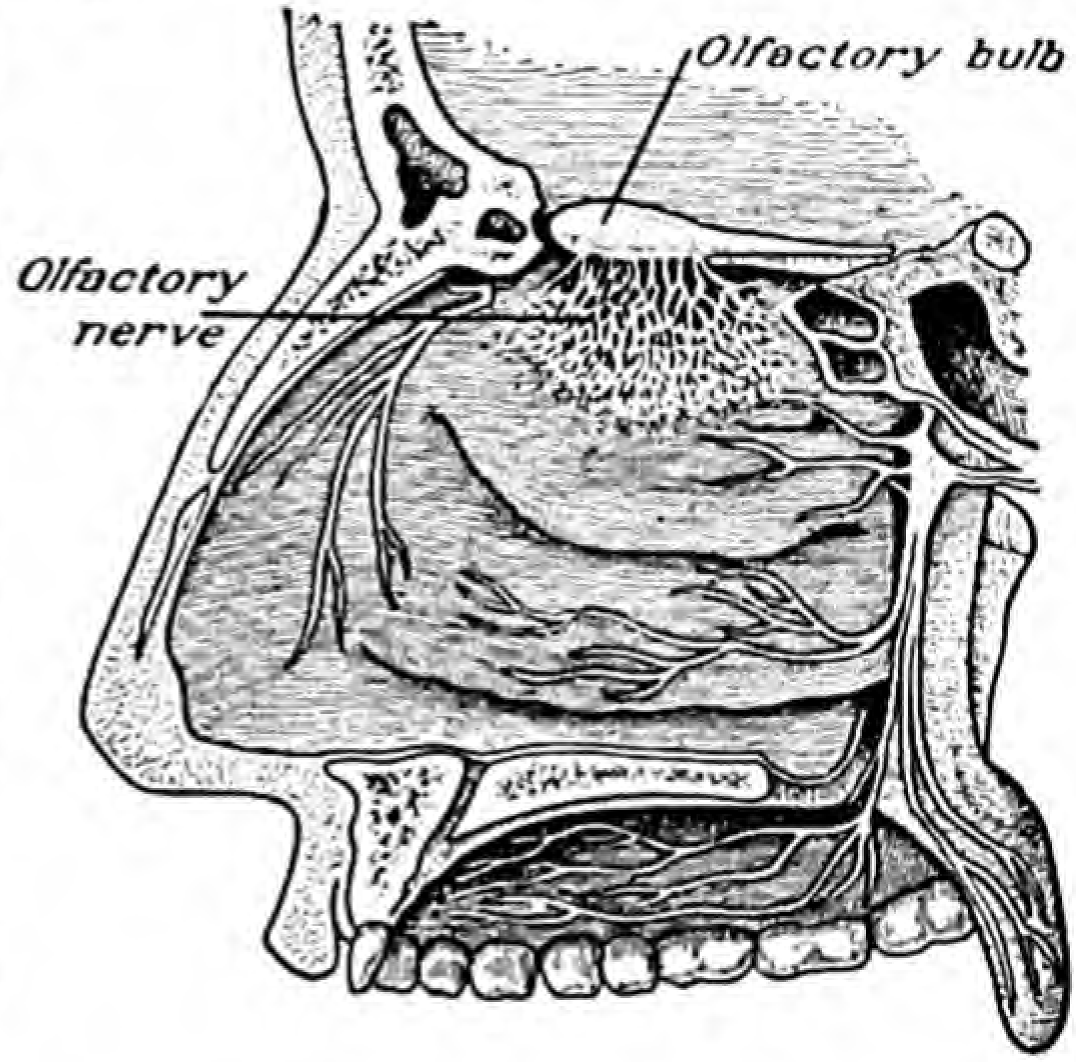


FIG. 38. — VERTICAL SECTION OF THE NOSE

The sense-organ for smell (Fig. 38) lies in the upper part of the nasal cavity. It is about the size of a dime, and its appearance is simply that of a brownish-yellow patch. Odorous objects give off gases, and these are breathed or sniffed up into the nasal cavity where they come into contact with the sense-organ. Just as there is an auditory nerve that conducts nerve impulses from the ear to the brain and an optic nerve that conducts impulses from the eye to the brain, so is there an *olfactory* nerve that conducts impulses

from the nasal cavity to the brain. These impulses reach the cortex in a region, which lies on the lower, middle surface of the brain (Fig. 35).

Perceptions of sights, sounds, and odors put us in touch with objects at a distance. — You will remember (Chapter II) that the eye, the ear, and the sense-organ of smell are among the *exteroceptors* or sense-organs that let us know what is going on outside of us. The other exteroceptors are the sense-organs in the skin that give us touch, temperature, and certain pain sensations. The eyes, ears, and sense-organs of smell are sometimes given another name, which is not applied to the sense-organs in the skin. They are sometimes called *distance receptors.* This is really a good name, because these senses put us in touch with objects and events which are at some distance from our bodies. We see the mountain, hear the bugle, and smell the rose, although what we perceive does not actually come into contact with our sense-organs. Ether waves, air waves, and gases are links between our sense-organs and the objects we perceive, but the fact remains that we perceive the mountain, the bugle, and the rose, and *not* the ether waves, air waves, and gas.

The distance receptors play a large part in making us as intelligent as we are. Perception, as we have remarked on a number of occasions, is essentially a means of getting ready for action. Because of our distance receptors, we are able to perceive objects and prepare for meeting them before they get to us or before we get to them. Because we are able to perceive the storm clouds on the western horizon, we can scamper for shelter. If we waited to perceive the cool drops of rain upon hand or cheek, it might easily be too late to escape a drenching. Because we are able to perceive the honking automobile before it reaches us, we can avoid being run down. And because we are able to perceive the foulness

of spoiled meat before putting it into our mouths, we can abstain from tasting it and running the risk of being poisoned.

Pressure or contact. — Through sense-organs in the skin and in underlying tissues we become aware of two fundamental pressure qualities, *light pressure* and *heavy pressure.* The difference between these is not a simple intensity difference, such as a difference in loudness between two tones of identical pitch and timbre or a difference in brightness between two otherwise identical colors. It is a qualitative difference, like a difference in pitch or in color. The nature of light pressure is best observed when we touch the skin ever so gently with a feather or hair. The light pressure quality can also be obtained in a fairly pure state if one brushes a finger over the hairs on the hand or arm. In order to observe the heavy pressure quality by itself, it is necessary to apply an anaesthetic to the surface of the skin. If this is not done, any stimulus which arouses heavy pressure will simultaneously arouse light pressure, and the mixture of the two is very difficult to analyze. An application of an anaesthetic to the surface of the arm will remove practically all possibility of perceiving light pressure. If, then, a heavy, blunt object is applied to the arm, we get in relatively pure form the perception of heavy pressure. The perception of heavy pressure occurs when the movements of our muscles stimulate the sense-organs that lie within them. For this reason heavy pressure is an important factor in our control of movement. The perception of hardness, softness, smoothness, roughness, wetness, dryness, and stickiness are only special cases of perception of light pressure, heavy pressure, or, as is more frequently the case, of some particular combination of the two. Sometimes temperature and pain, which we shall presently see to be other fundamental qualities, occur in conjunction with pressure.

Light pressure is perceived by means of little sense-organs scattered throughout the surface of the skin. Heavy pressure depends upon the stimulation of sense-organs of

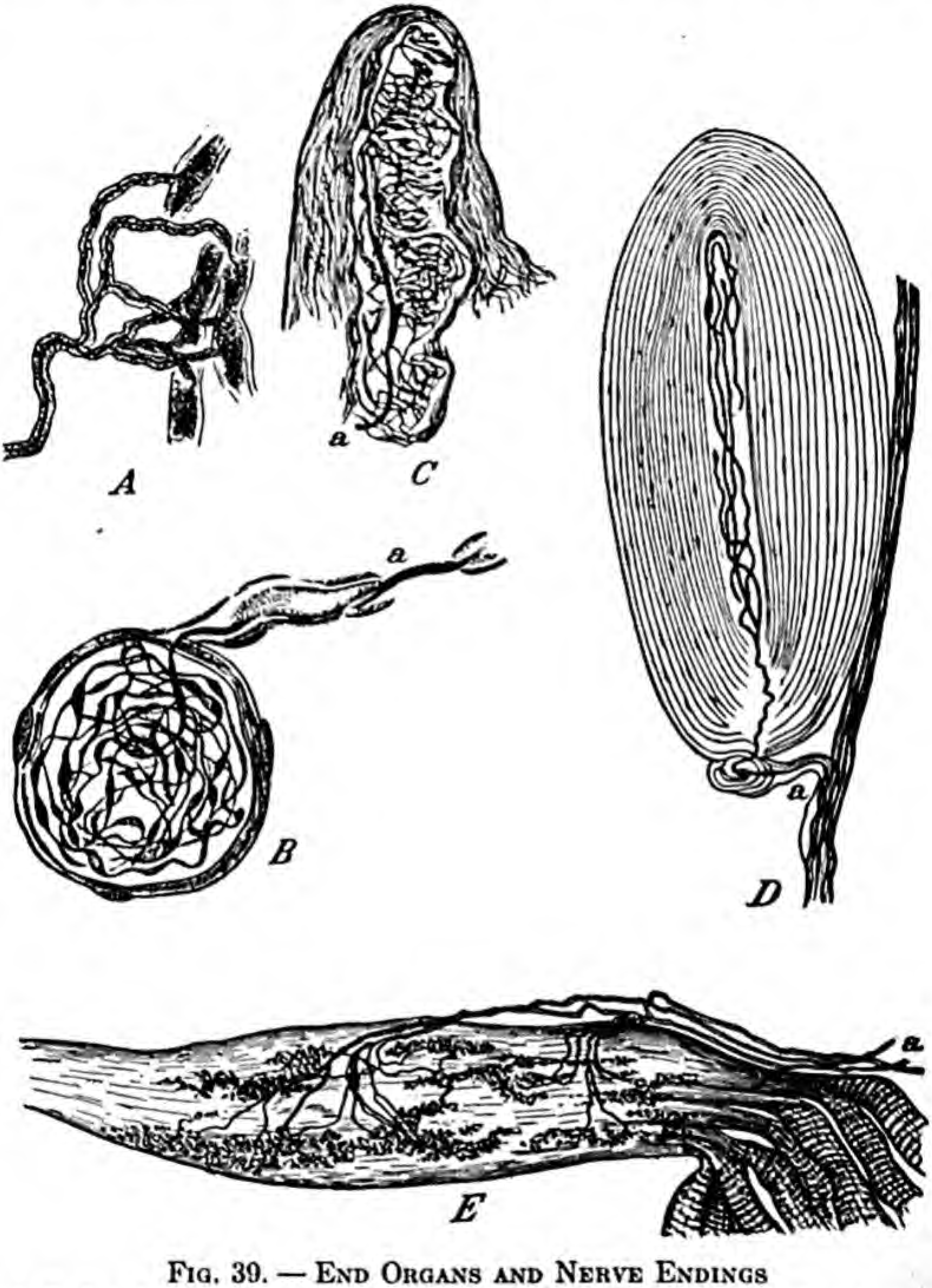


Fig. 39. — End Organs and Nerve Endings

A, B, C, and *D* represent end organs in the skin. *E* represents nerve endings in muscles and tendons. *a, a, a,* represent the nerve supply.

another type which are imbedded in the deeper layers of tissue which lie beneath the skin. The nerve impulses set up at these light pressure and heavy pressure sense-organs are conducted to the spinal cord or to the base of the brain, and finally arrive at a region of the cerebral cortex called, in Figures 34 and 35, the *body-sense area.*

Temperature. — There are two distinct kinds of sense-organs in the skin by means of which we perceive temperature. One kind is for warmth, the other for cold. So far as the physical condition of the stimulus is concerned, warmth and cold are only two different degrees of the same thing. The individual molecules of a warm object are in rapid vibration, and those of a cold object are vibrating more slowly. But the sense-organs affected in the two cases are quite distinct. For this reason there are said to be two temperature qualities, warm and cold. All other temperature qualities depend upon the activity of more than one kind of sense-organ.

In the perception of bitter cold the sense-organs for both cold and pain are stimulated. In the perception of burning hot the sense-organs for warm, cold, and pain are stimulated. The following table shows what sense-organs are active for different temperature perceptions:

	Warmth organs	*Cold organs*	*Pain organs*
Bitter cold	0	+	+
Cold, cool	0	+	0
Lukewarm, warm	+	0	0
Hot	+	+	0
Burning hot	+	+	+

After Titchener.

Impulses set up at the temperature sense-organs follow the same general route as those set up at the pressure organs, and they also arrive at the cortex in the body-sense area of Figures 34 and 35.

Pain. — There are many kinds of pain sensation, but just how many we do not know. Pain at the surface of the body is aroused by the stimulation, not of special sense-organs, but of the ends of nerves. Besides this skin or *cutaneous* pain, there is the ache of tired muscles, various kinds of headache, the griping pain of colic, and many others. Just where the nerve impulses involved in pain go to in the brain is not very clearly understood.

We usually look upon the perception of pain as a disagreeable experience. The pain quality at low intensities may, however, be neutral or even pleasant. There were, especially in the period of history known as the Middle Ages, religious fanatics who believed that the endurance of pain was one of the greatest of human virtues. Accordingly they inflicted all sorts of physical tortures upon themselves. There is no doubt but that some of them, after following this practice for a long period, got so that they really enjoyed pain. Nevertheless, our everyday attitude of considering pain as being disagreeable is fundamentally correct. When pain is perceived, it is, as a rule, high time to take warning, to discover the source of the pain, and to take steps for its riddance.

Taste. — There are, surprisingly enough, only four fundamental taste qualities; sour, salt, bitter, and sweet. The perception of these qualities depends upon four distinct types of sense-organs in the tongue. The manifold qualities, which in everyday speech we call flavors, are in reality quite complex. Almost always they depend upon odor and taste together, and frequently pressure and temperature enter into them. If the nostrils are plugged with cotton so that odors are practically excluded, one cannot tell the difference between the flavor of an apple and that of a raw potato. When we are suffering from a bad cold in the head

eatables seem to lose their flavor. We can still taste their sourness, saltiness, bitterness, and sweetness, but we are unable to smell. The brain region where taste impulses reach the cortex is probably in the neighborhood of that for odor.

Perception affected by adaptation of sense-organs. — Probably everyone has noticed that his coffee no longer tastes sweet after he has taken a few bites of sirup-covered griddle cake. The coffee is really unchanged, but his capacity to perceive its sweetness has changed. When we first dive into the water we perceive its temperature as intensely cold, but after we have been in for a few minutes the cold is likely to seem less marked. Here again what is perceived does not change, but the capacity to perceive it does change. In such cases as these the capacity to perceive an object or quality is diminished as a result of the fact that our sense-organs have been continuously exposed to it. This lowering of sensibility is called *sensory adaptation*.

Another illustration of what amounts to essentially the same fact appears in a psychological principle known as Weber's law. Let us suppose that we give a person a weight of 100 grams to lift. Now we wish to know how much heavier a second weight must be in order that our subject can just barely perceive the second as heavier than the first. We shall assume that after a certain amount of experimentation we find it necessary to get a second weight of 105 grams before the subject is able to perceive any difference between the two. After this determination, let us take away these two weights and give the subject a first or standard weight of 200 grams. Again we wish to know how heavy a second weight must be in order to be appreciated as heavier. In our first determination we discovered that in order to secure a just noticeable difference in perception

we had to have a difference of 5 grams between the two weights. But in our second determination we find that a difference of 5 grams does not cause a difference in perception. A difference of 10 grams is now required in order to give a perceptible difference. Evidently the heavier the standard weight, the greater the difference between it and the second weight required to make a difference in their perception. Weber's law states the facts more precisely:

> *In order to secure a just noticeable increase in the intensity of a perception, it is necessary to increase the stimulus arousing that perception by a constant fraction of itself.*

The constant fraction for lifted weights, according to our example, would be $\frac{1}{20}$. The fraction varies according to the senses involved, and also according to the general range of intensity within a given sense. But the important fact for us to remember is that our capacity to distinguish between two perceptions is not so much a matter of the absolute difference between their stimuli; it is rather a matter of their relative difference.

Sensory adaptation is aid to adjustment. — In the preceding chapter we said that the general tendency of attention to shift is of considerable advantage to us. Within us and around us there are always a great number of stimulating conditions. If any one of these conditions could arouse the same perception for an indefinite period, we should be at the mercy of the other conditions that we had not perceived. As it is, no sooner does a clear perception of one fact occur, than our attention so shifts as to make possible the clear perception of another. Now, one of the main reasons why our attention shifts as it does is because of the fact that the exposure of a sense-organ to one stimulus soon

decreases its sensitivity to that stimulus. And as soon as that decrease in sensitivity takes place, we tend to perceive new things to which the sense-organs are not yet adapted. Thus, sensory adaptation is one reason why attention shifts in the highly desirable way in which it does shift.

While sensory adaptation is an exceedingly important factor in the shifting of attention, we must be careful not to assume that it is the only factor. Sensory adaptation to pain is very slight. Yet one can get used to bearing pain, and can almost completely disregard it.

Perception affected by sensory contrast. — Prolonged exposure of a sense-organ to a particular stimulus results in more than a decrease in our capacity to perceive that stimulus. Such exposure, in reducing sensitivity for one stimulus, very often increases our sensitivity for other stimuli. If one looks at a red surface after the eye has become adapted to green, the surface will be perceived as redder than usual. An interesting experiment can be performed with three basins of water, one fairly hot, one fairly cold, and one of approximately the temperature of the air. If the hand is dipped directly into the last basin the water will be perceived as neither warm nor cold. But if the hand is put into the cold basin for a moment before being put into the neutral one, the water in the latter will be perceived as distinctly warm. Conversely, if the hand is put into the hot basin and then into the neutral one, the neutral will be perceived as distinctly cool. We have mentioned the bitterness of coffee when tasted after sirup. This is due to the fact that sensitivity for bitter is increased by exposure to sweet, as well as to the fact that sensitivity to sweet is decreased by that exposure.

As a matter of fact, sensory contrast can be said to operate hand in hand with sensory adaptation, and to further the

processes of adjustment in much the same way. By the principle of adaptation a stimulus has its most powerful effect only for a very short time. After that it loses its capacity to arouse a perception. By the principle of sensory contrast other stimuli (particularly those of an opposite type) get their capacity to arouse perception increased. Both of these make the shifting of attention more inevitable.

B. Perceptions Involving Several Senses

Perception of bodily position depends upon several senses. — The perception of the position of one's own body and its parts is aided by vision, by sense-organs in the muscles and at the joints, and by a special sense of equilibrium, the organs for which are in the ear. The last are called the semicircular canals (see Figs. 36 and 37) and the vestibule. The vestibule is the bulb-like structure with which the semicircular canals are connected. Usually these three senses operate together in our perception of bodily position. This is well demonstrated by the alteration which occurs in our perceptions if one of these senses is prevented from operating in its normal manner. In the disease called locomotor ataxia the nerve impulses from the sense-organs in the muscles are unable to reach the brain, owing to the destruction of certain pathways in the spinal cord. The characteristic thing about the sufferer from this disease is a peculiar, hesitant walk which is caused by his inability to get the "feel" of his legs. If vision is interfered with, the perception of position is also less efficient. There are many stories of military flyers who, when caught in dense clouds so that no familiar objects, such as the earth's surface, were visible, did not know whether they were flying right-side-up or up-side-down. Disturbance of the semicircular canals in man by the application of an electric

shock to the skull near the canals causes staggering and giddiness.

The perception of size. — The perception of size, bigness, or extent also involves a number of the senses. If they are equidistant from the eye, large objects affect a larger area of the retina than small objects. As a rule large objects, when touched, affect a greater area of the skin than smaller objects. It is usually true also that the exploration and examination of larger objects involve more extensive movements than the exploration and examination of smaller objects. Naturally the muscular sensations set up vary with the amount of movement. Hearing is not so important in the perception of size, but it is involved to a certain degree. Large objects, if they make any sound at all, usually make sounds which are louder and of lower pitch than those made by small objects.

The perceptions of size which take place by means of the different sense-organs are closely interrelated. In fact, one kind of sense-organ seldom works alone in the perception of size. When we perceive an object visually, our eyes do not remain fixed upon one part of that object. They move about, fixing first one point and then another. Thus we get data for the interpretation of the object's size, not only from vision, but also from the muscles employed in eye movements. Furthermore, our interpretation of the size of a seen object is rendered more complete because of the fact that we have handled and explored the same object or similar objects on other occasions.

Perception of distance. — This brings us to the perception of distance, which involves especially the eyes and the sense-organs in certain muscles controlling eye movement and the adjustment of the lens. The muscles controlling eye movement are shown in Figure 40

When an observed object approaches us our eyeballs must turn inward toward the nose. This turning of the eyes arouses nerve impulses in the muscles of the eyes. In order to keep an approaching object in clear focus it also is necessary for the lens to bulge. This bulging of the lens probably arouses other impulses, and they, with the impulses from the eye muscles, give an indication of the distance of the object at which we are looking. It is possible to see the sides as well as the front of a near object, unless it be very large, and this also helps us to perceive distance. Near objects have the property of at least partially cutting off our view of objects that are farther away. This, of course, gives a valuable clue to distance. On the water it is often very difficult to perceive distance accurately because the view is so unobstructed. One other factor of importance in perception of distance is the clearness of vision. The farther away objects are, the more clothed they become in an atmospheric haze. This even changes their natural colors. The distant green hills appear blue. In the Rocky Mountain country the air is exceptionally clear, and distant objects do not have the haze about them that they do in the east. For this reason easterners, upon first going out there, are likely to perceive a mountain which is in reality many miles away as if it were within easy walking distance.

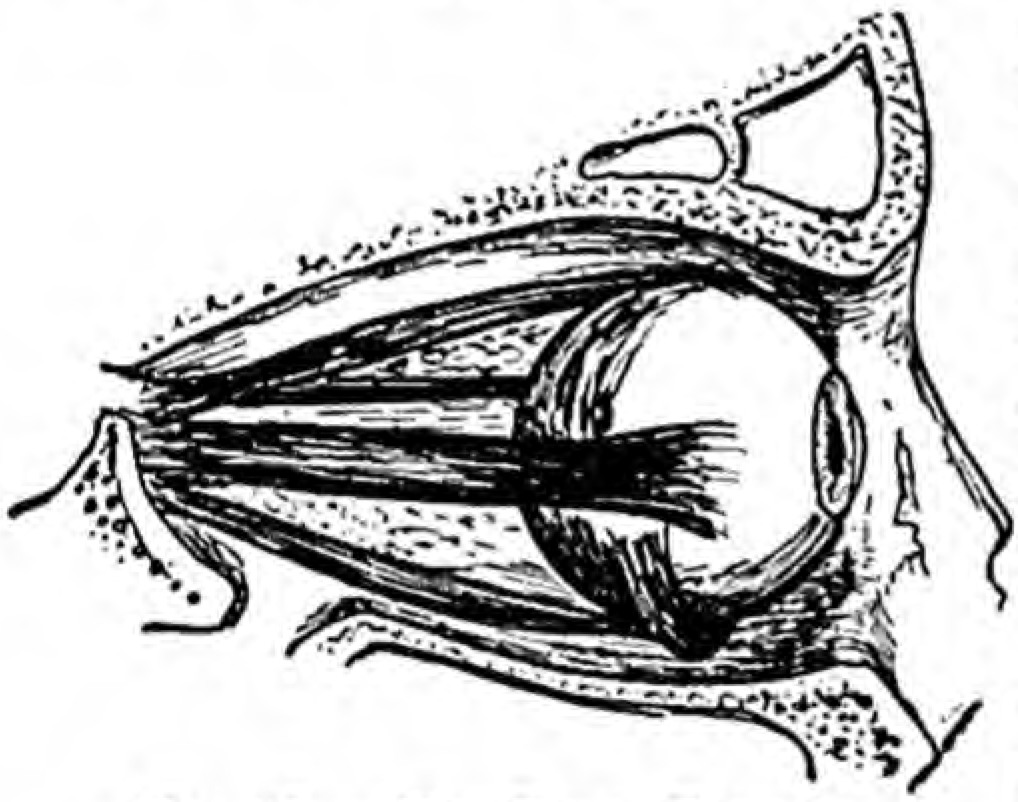


FIG. 40. — THE RIGHT EYEBALL

This drawing shows some of the muscles that move the eyeball.

But the perception of distance is not entirely accounted for

by the factors just mentioned. There is reason to doubt whether we should perceive distance if it were not for our habits of moving about in space. If we kept our bodies in the same place all the time our eyes might be affected by distance, but we should never pay any attention to distance, and consequently we should never learn to perceive it.

We have named only a few samples of the qualities that can be perceived. — In the present chapter we have mentioned only a few of the multitude of perceptible qualities that exist. If we were to enumerate them all, we should have to include location, speed, strangeness, and perhaps several hundred or thousand others. But in mentioning brightness and color, noise and tone, odor, pressure, temperature, pain and taste we have considered the simplest perceptible qualities. They are simplest because the perception of any one of them depends almost entirely upon the operation of only a single sense-organ. Most perceptible qualities, on the other hand, depend upon the operation of two or more senses. Take the case of size, which we were just considering. It seems as if one simply *sees* how large an object is, but it is doubtful whether we could perceive size at all if it were not for the sense-organs in the muscles of the eye which indicate the movement and position of the eye.

Summary of the Chapter

1. A classification of perception according to the different senses will give a good idea of the extent of this variety of mental activity. Such a classification cannot, of course, enumerate every perception possible, because, if we count those perceptions depending upon the operation of the same sense in different ways or upon the operation of a combination of senses, the variety of perceptions is practically endless.

2. Through the eye we perceive achromatic qualities and chromatic qualities. The former can be represented by a series of values lying along a straight line. The latter can be represented by a series of values lying along the circumference of a circle. These two figures, when combined into the color spindle, represent a complete array of visual qualities.

3. Weakness in color perception sometimes depends upon an inherited deficiency in the sensitivity of the eyes to color. Individuals who possess this deficiency are often able to identify many colors by means of brilliance and other characteristics of colored objects, but the deficiency can be detected by proper tests. Weakness in color perception is sometimes only a matter of lack of practice in dealing with colors.

4. Light comes to the eye in the form of very rapid and very short vibrations of the ether. If the eye is affected by a mixture of many different vibration lengths, we perceive white, gray, or black. If the eye is affected by a single vibration length, we perceive a color. Colors can also be obtained from some mixtures of different vibration lengths.

5. The actual sense-organs of vision are the rods and cones located in the inner coat or retina of the eye. It is here that the nerve activity is set up which is conveyed by the optic nerve to the brain.

6. Through the ear we perceive noises and tones and the two in combination. Noises are not susceptible of satisfactory classification, but tones fall into a regular series according to their pitch. Complex tones can be distinguished according to their *timbre*, that is, according to their components.

7. Some persons have much better capacity than others to discriminate between tones of different pitch. The

possibility of developing a high order of musical ability is slight unless one has good tonal discrimination.

8. Sound comes to the ear in the form of vibrations of the surrounding air. The slower vibrations arouse perceptions of low tones; the faster vibrations, perceptions of high tones.

9. The sense-organs for hearing are located in the cochlea, a small structure resembling a snail shell. The nerve impulses here set up are conveyed to the brain by the auditory nerve.

10. Although many odors can be accurately identified, it has not been possible to arrange them satisfactorily into any such orderly scheme as the ones which we have for colors and tones. The sense-organ for smell lies in the nasal cavity, and it is excited by many gaseous substances which come into contact with it.

11. In the perception of sights, sounds, and odors we take account of objects at a distance. This is especially important for intelligent behavior, because it makes possible preparation to meet situations before they have actually arisen.

12. The fundamental pressure qualities are light pressure and heavy pressure. These qualities are dependent upon the stimulation of sense-organs in the surface of the skin or in the deeper tissue.

13. There are two distinct temperature qualities each of which has its own type of sense-organ. These qualities are warmth and cold. In the perception of extremes of temperature pain also is involved.

14. There are a number of kinds of pain, cutaneous pain, sub-cutaneous pain or ache, headaches, the pains accompanying abnormal conditions of the internal organs. Pain is not necessarily unpleasant, but it usually is.

15. The taste qualities are sour, salt, sweet, and bitter.

Most of the flavors that we perceive are mixtures of taste and odor qualities.

16. Sensory adaptation and contrast are prominent factors in perception. As a rule the exposure of a sense organ to a single type of stimulation decreases its sensitivity for that stimulation and at the same time increases its sensitivity to stimulation of other types. Adaptation and contrast furnish one explanation as to why attention is as shifting as it is.

17. Bodily position is perceived as a result of the co-operative action of vision, the muscle sense, and the special sense-organs of equilibrium which are located in the inner ears. The perception of size and distance are other instances of the combined action of different senses in perception. Of course these are merely examples of the innumerable complex perceptions which occur in everyday life.

PROBLEMS

1. Can you think of any way of classifying perceptions except in terms of the different senses? Would such a classification be satisfactory?

2. Give a list of situations in which accurate visual perception could not take place without the presence of other than visual qualities.

3. If all locomotive engineers were color blind, what kind of visual signals could be used on railroads? Why?

4. Practice drawing a cross-section of the eye and designating its main parts until you can do so from memory.

5. In vision it is possible to perceive two colors at once without their being mixed. Why is this not possible in the perception of sounds?

6. Why is keener tonal discrimination required of one who plays the violin than of one who plays the piano?

7. Practice drawing the interior of the ear and designating its parts until you can do so from memory.

8. Why is it appropriate to speak of smell as "taste at a distance"?

9. Explain why it is that our ability to perceive objects at a distance makes possible our preparation for future events.

10. Press the palms of the hands together. Can you distinguish the pressure felt with the right hand from that felt with the left? Explain.

11. In initiation ceremonies the blindfolded neophyte is sometimes told that his arm is to be branded with a red-hot iron. A piece of ice is then pressed against his bare arm. Why is it so easy for him to believe that he has really been burned?

12. Lukewarm coffee hardly seems to taste like coffee at all. Why?

13. What are some cases of sensory adaptation besides those mentioned in the text?

14. What are some cases of sensory contrast besides those mentioned in the text?

15. What are some cases of complex perception, *i.e.*, perception involving the action of more than one sense, besides those mentioned in the text?

REFERENCES FOR FURTHER STUDY

Sanford, *American Journal of Psychology*, 1912, pp. 59–65; or *Readings in General Psychology*, Ch. VI, Selection 4-A, p. 153 ff.

Helen Keller, *The World I Live In*, pp. 5–8; or *Readings*, Ch. VI, Selection 4-B, p. 159 ff.

PART IV

IDEATION

CHAPTER IX

IDEAS AND CONCEPTS

A. THE FORMS OF IDEATION
B. WHAT IDEAS STAND FOR
C. THE ASSOCIATION OF IDEAS
D. CONCEPTS

QUESTIONS TO KEEP IN MIND WHILE READING THIS CHAPTER

1. In what forms do our ideas occur?
2. What do ideas represent?
3. In what sense are ideas preserved?
4. What is meant by *the association of ideas?*

Ideation is the second fundamental form of knowing, or cognitive, activity. Sometimes ideation is spoken of as symbolic activity, because by means of it we deal, not directly with actual objects and events, but with ideas which stand for the actual.

We shall devote four chapters to this subject. In the first of these there will be a description of the forms in which our ideas occur. We shall see how ideas sometimes take the form of what are called images, which are not unlike direct experiences of objects in perception. We shall also see how words and bodily movements and postures may function as ideas. There will be a discussion of what ideas stand for and of how ideas are organized by experience into what are called concepts. We shall see something of different types of concepts and their development. Finally, we shall consider the important part played by words in making possible the use of these concepts.

In the second chapter on this subject we shall see how the ideas of memory enable us to live over the past. Something will be said about the difference between an efficient and an inefficient memory, and of the rules which must be followed if the best results are to be obtained in memorizing. The questions will be raised as to why it is that we forget and why our forgetting is sometimes rapid and sometimes slow. At the end of this chapter we shall take up some of the typical errors for which our forgetting is responsible.

The third chapter of this part of the book will have to do with the occurrence of ideas in new combinations. We shall discover how it is possible through ideation to get in touch with that which has never been present in our personal experience. It will be seen what influences make for originality of thought and what for conventionality. We shall learn that original combinations of ideas may be the result of long and arduous effort or that they may occur in what seems to be a wholly spontaneous manner. And we shall consider how unnecessary it is to explain the relatively spontaneous type of originality as resulting from some supernatural inspiration. Something will be said also about dreams and fantasy, and about the relationship between imagination and the affairs of everyday life.

The final chapter of this part will have to do with the use of ideas in the solution of problems, that is to say, in reasoning. We shall see both the advantages and limitations of reasoning. Since the basis of sound reasoning lies in the possession of reliable information, there will be a description of some of the ways, both accurate and inaccurate, by means of which information is collected. But even with reliable information, our reasoning often goes astray. Therefore it will be necessary to learn some of the typical difficulties in the way of sound thinking. Reasoning, of course, usually

results in conclusions. We shall see what kinds of conclusions there are. And lastly, we shall see the relationship of reasoning to overt movement and to further thinking.

Ideas, like perceptions, are intellectual reactions. — A few moments ago I turned my eyes toward a book upon my study table. At once there was aroused in me an act — an act of understanding that the object before me was a book. Some time before there was a sound which aroused in me another act — an act of understanding that a co-worker of mine was opening his office door. As we have elsewhere remarked, such perceptions are not simply impressions which books, sounds, and other objects or events make upon us. They are also active responses on our part to what is going on within us and about us. Ideas, like perceptions, are definite reactions. If the book is removed from the table so that I can no longer perceive it, I still can have an idea of it. And in having that idea I am indulging in action just as truly as I was while perceiving the book.

A. The Forms of Ideation

Imagery is one form of ideation. — Whenever I have occasion to think of the school I first attended, an experience occurs that is very like actually seeing the red-brick building itself. Late one afternoon I set out upon a walk with one of my friends. In my pocket I carried a letter that I intended to post in a box at the corner. After we had walked perhaps half a mile, I stopped suddenly and asked my companion whether I had posted the letter as we passed the box. He could not remember, nor could I for a moment or two. All at once an experience occurred which answered my question. I seemed to hear the post-box "thump" as it does when one lets go of the door. Now experiences like seeing a school

house which was really miles away and like hearing the thump of the post-box which had been left behind some minutes before are called *images*. It is sometimes said that images are mental *pictures*, but that is not a very good way to put it, because images can be like sounds, tastes, odors — in short, like the perceptions through *any* of the other senses as well as like those through the eye.

An image is like a perception except that it is seldom as definite and that the object which the image represents is not actually affecting the sense-organ. The distinction between imagery and perception is usually an easy matter. Ordinarily, it is easy for me to know when I am looking at a house and when I am having an image of it. The image of the red-brick school building is not as vivid as the actual sight of the building would be and, furthermore, while I am aware of that image, I am also aware of other thoughts, objects, and so forth, which keep me reminded that I am miles away from the structure my image represents. Still, there are situations in which imagery is quite likely to be mistaken for perception. This is true in dreams. Although we are occasionally aware, while dreaming, that our dream images are unreal, we are more frequently completely deceived by them until we awake. In conditions of great emotional excitement and in mental disorders there are very likely to be frequent confusions between imagery and perception. The two are also readily confused when external stimuli are weak. I have in my room a stubborn little clock which has the habit of stopping in the middle of the night, thereby causing me much inconvenience in the morning. One night, just before going to sleep, I listened to discover whether the clock was at work. The longer I listened the more uncertain I was as to whether I was hearing an actual "tick, tick, tick" or whether I was imagining it. When I

finally got up and walked over to the clock, I discovered that it really had stopped and that the ticking was auditory imagery rather than perception.

The uses of imagery. — Many people have noticed that as they have acquired a more thorough mastery of words and as they have become more and more concerned with relatively abstract affairs, their imagery has become extremely fragmentary. They have come to think in terms of words rather than in terms of images. The question has often arisen as to whether or not this loss of capacity for producing clear images is a disadvantage. It seems reasonable to suppose that vivid imagery may under certain circumstances be of considerable importance. Would not the poet be aided by a vivid visual image of the natural scene he is trying to describe from memory? Would not the inventor be aided by a clear visual image of his completed machine? Would not the composer be aided by being able in clear auditory imagery to go over the melody he is in the act of composing? It seems that the answer to all these questions should be an unqualified "yes." And yet the skilled psychologist will tell you that the matter is not so simple. Beautiful poetry *can* be written with scarcely any use of imagery. There have undoubtedly been capable poets who have thought directly in terms of the words they have written. It is possible to compose a melody without being aided by auditory imagery. The composer may sit down at the piano and make up the tune in terms of actual sounds without reference to any imaged ones. The machine designer often has to have pencil and paper before he can begin to work. This is evidence that he does his thinking in terms of the lines he actually draws while thinking, rather than in terms of imagery. There is no doubt but that some poets, inventors, and composers, perhaps the majority of

each of these groups, work out their poems, designs, and compositions through imagery, but it is our point that almost any result of thinking may be produced by any one of a number of forms of thought. The poet, while writing, may experience a visual image of the natural scene he is describing; the words he puts down upon paper may come to him as if spoken by another's voice; or he may be oblivious of almost everything except the actual movements of writing.

Form and reference of ideas must be distinguished. — A distinction must be drawn between *what ideas are about* and the nature of the ideas, that is, whether they are images, words, or of some other form. The reason why it has frequently been supposed that poets and inventors must have vivid visual images, that composers must have clear auditory images, and so on, is that there has been a constant confusion between *what the idea is about* and *the form of the idea.* Poets and inventors certainly do think *about* visual objects, about objects whose visual qualities are predominant over their other qualities. But this does not mean that these objects can be thought about only through visual imagery. If one has a sufficiently wide and accurate vocabulary there is hardly a visual quality that he cannot think about in verbal terms.

Language is another form of ideation. — Language is a form of thought which makes it possible for people to think together, to understand each other, and to carry on communication. But when a language is mastered it frequently replaces imagery, even in the private thinking of the individual. Some people cannot think easily unless they talk aloud to themselves. Some lecturers get their best ideas while they are actually lecturing. In these cases, thinking in terms of spoken words has become so habitual that thought goes on best in that form. Many of us who do not

talk aloud to ourselves and who do not do our best thinking while speaking to other people, do nevertheless carry on our thinking in words. While absorbed in a train of thought, we are engaged in inaudible speaking. As a rule the person who thinks in this way is not aware of the form his thought is taking. He knows what he is thinking about, but the fact that he is really talking to himself wholly escapes his notice. Only very careful self-observation is capable of revealing to him the manner in which he thinks.

Language has its written as well as its spoken form, and some persons, especially professional writers, get to a point where they depend upon paper and pencil, or typewriter. Their ideas, as was suggested when we were considering the poet's need of imagery, take the form of actual movements of writing.

It is the custom to think of the public speaker — that is, the extemporaneous speaker — as having ideas "in his head" which he translates into the spoken word, and of the writer as having ideas "in his head" which he translates into the written word. It is nearer the truth to think of the speaker's ideas as coming directly into his mouth and of the writer's ideas as coming directly into his fingers. Young writers are sometimes advised to "think right into the typewriter." This is only another way of saying that, if one wishes to write down ideas, it is better to have the ideas occur as writing movements than as images or spoken words which have to be translated into writing.

Words, themselves, may take the form of images. — We have described how ideas may occur as audible or inaudible speaking and as the actual movements of writing. Under these circumstances, thinking in verbal terms is something distinct from thinking in terms of imagery. It is perfectly possible, however, for thought to go on in terms of

imagery and still be verbal thought. My idea of snow, for example, may take the form of a visual image of the printed word, "snow," or of an auditory image of the sound of the same word. It is even possible that, without actually making any such movements, I may have an image of the movements of tongue and throat when I pronounce the word.

Movement and bodily posture are sometimes ideation. — Movements other than those of speaking and talking may serve as ideas. Movements and postures which lie outside the realm of verbal language may be ideas in every sense in which images and words are ideas. The frown that crosses the meditator's face is not simply an outward expression of an idea. It frequently has of its own right, so to speak, a meaning and significance that make it an idea. The same thing is true of the many other changes in facial expressions, gestures, and muscular contractions and relaxations of trunk and limbs that take place during thinking. To the degree to which these acts stand for something beyond themselves they are ideas.

The form of ideation is sometimes undetectable. — We are at times quite clear as to the meaning of our ideation without being able to detect whether the ideas concerned are images, or movements, verbal or non-verbal. At noon I may think that I ought to be stopping my work and going to lunch. If, after having undergone this process of thought or ideation, I ask myself just what images, movements, and words made up my thinking, I may be unable to give any account of them whatever. Professor Woodworth has given the following example of this point:

While reading I heard someone playing on the piano a piece which I felt at once to be familiar, but which I did not at once identify. My first attempt at identification was felt to be wrong, and immediately afterward I identified it properly and

with confidence. In doing so I thought of the first part of the piece (it was Chopin's 'Funeral March,' and the part being played when it caught my attention was the trio). Resting satisfied with my identification, I was about to turn to other things, when it occurred to me to ask whether, in identifying the piece, I had had its name present in the form of verbal imagery, and I found that I certainly had not; in fact, it required a moment's further thought to recall the sound of the composer's name and the name of the piece. Nor, in locating the trio as a trio and thinking of the character of the march proper, did I have an auditory image of the march.[1]

It is, after all, not so strange that we are sometimes unable to describe in just what form our ideas occur. We have commented upon the fact that the expert performer of an act of manual skill can seldom describe in detail exactly how he accomplishes such good results. We are also familiar with the fact that many of the commonplace and oft-repeated acts of life go on so automatically that we are unaware of their precise nature. A person who has been reared in the South and who has a firmly established Southern accent may live for years in the North with little or no realization that his speech differs radically from that of his companions. Similarly, our thinking sometimes becomes so automatic that, although we know perfectly well what it is about, we do not know how it goes on.

B. What Ideas Stand For

Ideas stand for objects and for events. — Ideas are something like events upon the stage. They are important principally because of that for which they stand. The villain's raging and the lady's tears are not based upon real rage and grief, but they represent what have been or might some time

[1] Quoted from *Journal of Philosophy, Psychology and Scientific Method*, III, 1906, p. 705, by Breese in *Psychology*, pp. 352–53.

be realities. And, in thus representing these realities, they are reacted to by us a good deal as if they were realities. They are met, respectively, with active hate and sympathy. The idea of skidding on a wet pavement is not a reality in the same sense that the actual skidding would be. Ideas of skidding do not break wheels off motor cars. And yet such an idea is often reacted to as if it were the actual experience of skidding. When the idea of skidding occurs to a driver he is very likely to press his foot less heavily upon the accelerator. Hold up your forefinger, looking at it closely; now think of a very sharp knife cutting into it. Do you feel like pulling your finger away? Was the effect of the idea of the knife anything like the effect of an actual knife?

Because ideas are more important for what they represent than for what they are, people have often written of them as though they were unreal, supernatural things. Nothing could be further from the truth. Ideas are no more supernatural than events upon the stage. Like those events, they are more important for what they mean than for what they are, but nevertheless their own nature may become as interesting at times as do the personality and private life of some famous player, or the mechanical devices by means of which theatrical effects are attained. In the preceding sections of this chapter we, ourselves, kept our attention upon the various forms in which ideas occur with only a casual reference now and then to what those ideas represent.

Ideas represent the past. — Ideas enable us to live again experiences that are past. When I image the building in which I first attended school, I am partially duplicating acts of perception that took place years ago. When I image the sound of the closing post-box, I partially relive a past experience. Life is rendered richer and more significant by this capacity to revive in the shape of ideas the pleasant,

tender, and exhilarating moments of the past. Think of the barrenness of an existence cut off from all possibility of knowing its own past! This knowledge of the past has, also, its practical uses. Here is a man who, during a cold and stormy evening, has to reach a distant part of the city as quickly as possible. He thinks of going by steam train, but realizes that that would require a long walk at each end of his journey. He thinks of going by the elevated, but that would require an even longer exposure to the storm. Finally the idea comes to him that on a similar occasion some weeks before he had taken a surface car and reached the same destination with very little walking. On the basis of this idea of the past he is able more intelligently to select a way out of his present difficulty.

Ideas represent the future. — The man who pays no attention to the possibilities of the future is stupid and unintelligent. The future always enters into those considerations that guide the wise man's conduct. Now, the future cannot actually be met until we get to it, but what it is likely to be can be represented by ideas. Where ideas play a part in problem solving, some of those ideas must represent the future. Consider again the man who wishes, on a cold and stormy night, to reach the city as promptly and comfortably as possible. The solution of this problem is, in a way, as we have already indicated, based upon an idea of a former trip to the identical destination. There are present, however, other ideas with an almost purely future reference. The very realization that there is any problem that needs solving depends upon an anticipation that there is an appointment to be met an hour from now. The thinker's rejection of the ideas of going by steam or elevated is dependent upon his anticipation of the discomforts which will be his if he puts either of those ideas into operation. And his selection of

the surface car is based, not alone upon an idea of a former, successful trip upon it, but also upon an idea of what that method of travel will mean during the evening that lies before him.

Ideas extend the bounds of personal experience. — By means of ideas a person can deal, in the present moment, with events that have been experienced in the past and also with events that are to be experienced in the future. But ideas do even more. They put him in touch with events which he has never directly experienced and is never likely to experience in any direct way. The polar explorer, through word of mouth or pen, arouses vivid ideas of that country in another who has not visited the arctic region. Likewise the soldier, the poet, the master in business, the leader in politics, and others who have had unusual experience arouse in us ideas through which we know experiences that it would be out of the question for us actually to go through.

By putting ideas together in new combinations we can of our own initiative extend our mental life into regions untouched by our personal, concrete experiences. The author constructs a plot, and the ordinary man weaves a day-dream. In both cases events are thought about which have never been actually experienced and are not likely to be. The ideas that the author puts into his novel and the ordinary man into his day-dreams are based upon earlier personal experiences, but the present combinations into which they are put are distinctly new. Tom Sawyer, Tom's aunt, Huckleberry Finn, and the rest of that company never entered the concrete experience of Mark Twain in precisely the form in which he has described them in his stories. There is no doubt, however, but that during his contacts with people, he actually observed imaginativeness, quick temper mixed

with kindliness, untutored ingenuity, and the many other traits with which he endowed his fictitious characters.

History, sciences, and all other bodies of knowledge are collections of ideas. — Civilization without ideas would be impossible. Our laws, our political institutions, our religious beliefs, our artistic standards, our mechanical devices, and the control which has been achieved over disease are dependent upon bodies of knowledge or collections of ideas. Present-day life is deeply affected by the history of the human race. No one remembers history in the same concrete way in which he remembers the past events of his own life, but written history is capable of arousing ideas of human struggles and achievements during earlier days. No engineer in designing a bridge can, himself, remember the discovery of all those physical principles which must be taken into account in his plans. Indeed, that is unnecessary, because the ideas resulting from those discoveries have become incorporated into the bodies of knowledge called Physics and Engineering, where they are available for anyone capable of studying such subjects. No physician is likely to observe, during his hospital training, an actual example of every disease with which he will later be called upon to deal. Through books and lectures, he will, nevertheless, get ideas which will extend enormously the bounds of his experience.

Ideas, themselves, are not preserved. — We have discussed how ideas can bring back the past, represent the future, and give us access to realms beyond our personal experience. Sometimes, for the sake of convenience, we speak as if the ideas which bring about these results are stored up in the mind or among the printed pages of a book, from which they can be extracted when one wishes to refer to them. But, unless we are very careful, such a state-

ment may lead us into a misconception of the nature of ideas. It is likely to lead us to think of ideas as objects, when they are not objects, but activities. They are activities just as moving one's feet, digesting a meal, and perceiving a voice are activities.

While one is not actually moving his feet, digesting a meal, or perceiving the sound of a voice, he still retains a *capacity* to do these things. This does not mean that the moving, digesting, and perceiving are retained, but merely that one will later be able to carry on these activities when the proper circumstances arise. Where is your voice when you are quiet? It is generally agreed that certain conditions of the nervous system are retained which form the basis of this ability to carry on these activities. Similar facts are true in regard to ideas. I am able to image with fair clearness my bookshelves at home whenever I wish to do so. That certainly does not mean that I carry this image around with me. It means only that I preserve the capacity, probably in the form of a certain brain condition, to carry on this process of imaging.

In the preceding section we spoke of history, the sciences, and other bodies of knowledge as being collections of ideas. These ideas, we implied, are preserved in books. It is not literally true, though, that a book is made up of ideas. Ideas are acts carried out by live people, and actual ideas do not exist nor occur except as they are manifested by some individual person. What is preserved in the book, then? The book contains printed words, pictures, and other symbols which are capable of actually setting in motion the formation of ideas in him who reads. Ideas are no more in the book when it is not being read than is moving my feet in me when the movement is not taking place.

Ideas prepare the way for overt action. — Thus far our study has shown us that ideas are not objects, but actions; that these actions are imaging, using words (either to ourselves or in such a way that others, too, can understand them), movements, postures, and certain processes the nature of which cannot be directly observed; that these ideas are more important for what they represent than for the particular form they take; and that through these ideas we are put in touch with the past, the future, and with experiences which we, personally, can never have.

We now have to consider the relationship between these acts that are important mainly in what they stand for and other acts which are important in themselves. Such an act of movement as stepping over a curb achieves an immediate and important result. It keeps me from tripping and puts me safely out of the street and on the walk. An *idea* of stepping over a curb, on the other hand, does not affect my actual position in regard to street and curb. Nevertheless, such an idea may prepare the way for the actual stepping movements. As a matter of fact, such simple obstacles as curbstones usually arouse appropriate movements without the occurrence of ideas, but there are many cases where appropriate movements do depend upon the ideas that precede them. Consider the example which we have used of a man selecting one out of a number of methods of traveling to a certain destination. The final movements that actually take him to his car were prepared for by the idea of the route selected and ideas of the merits of this route compared with those of others.

Ideas, like perceptions, typically prepare the way for immediately important movements. However, as in perception, ideas do not always result in such movements at once. As I sit at my typewriter I may think of a

certain book which I intend to draw from the library on my way home this evening. That idea is not followed at once by my leaving my present task and going to the library. The chances are that I shall not do anything about the matter until some hours hence. Ideas may also occur that never have any important effects upon my overt movements. This morning it was very cold and snowy, and as I came to the laboratory I thought about being in the arctic regions and what life there must be like. It is extremely doubtful whether those ideas will ever have any appreciable effect upon my conduct. We may conclude, then, that while ideation typically prepares for important movements and plays a part in determining conduct of a more complete sort, it does not always do so. Much activity, such as my thinking of life in the arctic, hardly gets beyond the ideational stage.

It is sometimes held that thought, or ideation, which fails to affect our behavior in a clear, tangible manner is fairly useless. The ideas of astronomers in regard to the position of the heavenly bodies result in guides for navigators to follow in the sailing of ships. But not all ideas that astronomers have in regard to the planets and the stars have such practical consequences. Many of these ideas have to do simply with the colossal magnitude of the universe and the relative insignificance of this little earth of ours. Such ideas carry man out of the humdrum monotony of his everyday life and broaden his intellectual horizon. They may not lengthen his life or increase his worldly goods; they may not alter his daily conduct in a way that anyone can observe; but they are capable of giving his experience a depth and perspective which make life more worth living.

Ideas are acquired. — We have distinguished between acts which are acquired or learned and those which can

be performed without any particular training and experience. The first group of acts we called habits. The second group we called reflexes. Now ideas are in all cases learned activities. Although an individual may from birth be capable of performing a vocal movement or a limb movement which later constitutes the form of an idea, personal experience is necessary before such an activity can stand for something. And until an activity comes to stand for something besides itself, it is not an idea.

Ideational acts are habits not alone because of the fact that the connection between their form and their significance has been acquired through experience. These acts are also to be understood as habits because the circumstances under which they occur have been determined by personal experience.

C. The Association of Ideas

The association of ideas. — Ideas, as a result of the experiences through which an individual passes, tend to be aroused either by perceptions or by other ideas. My perception of the snow and cold aroused in me certain ideas of the arctic. My perception of clouds in the sky arouses in me the idea of a possible storm. Furthermore, the idea of the arctic is capable of arousing ideas of other parts of the world, such as the tropics, and the idea of a possible storm is capable of arousing ideas of umbrellas, raincoats, and the good fortune of the farmers.

These connections between ideas and perceptions and between ideas and other ideas are called *associations*. Strictly speaking, such connections as that between the perception of a curbstone and the movements of stepping over it, or between the sight of an oncoming tennis ball and the movement of swinging the racket, are associations just as truly as those

in which ideas are involved, but it has been the custom for psychologists to use this term principally where ideas are concerned. Perhaps the main point for us to keep in mind is that the connections or associations between perceptions and ideas and between ideas and other ideas are simply special instances of habit, a topic about which we have already had much to say.

Associations are either successive or simultaneous. — Association is most clearly observable in the sequences of our ideas and perceptions. One sees a book, and a moment later one has a visual image of the author whose picture he saw the other day in a magazine. One thinks of the approaching close of the school year, then of the month of June, then of a birthday that he must not forget. Such sequences reveal associations or organizations among ideas and percepts of a type familiar to almost everyone, whether he be a psychologist or not. They are *successive* associations.

There is another type of associative connection which is somewhat less obvious, but certainly no less important for mental life. In the actual moment of perceiving a house there is present an idea of its occupants, and perhaps even the beginnings of the muscular movement required in the pronunciation of a name. In the moment of perceiving a block of ice there are present ideas of coldness and heaviness. Such organizations are called *simultaneous* associations. The reason why they are less frequently noticed by the casual observer is that he tends to accept each moment of experience as a whole. He rarely analyzes it as he does a chain of successive experiences.

What ideas and perceptions are associated? — It is perfectly possible for any idea to become associated with any other idea or with any perception. There is a certain house, the perception of which always makes me think of a

man who died there about fifteen years ago. There is nothing about the mere appearance of the house to call to mind anyone in particular, and I daresay that the majority of the people who pass that house today are never reminded of its former occupant. But I am reminded of the man because, a long time ago, I formed the habit of thinking of him and his house together. People in foreign countries would not be likely to think of baseball upon thinking of peanuts or upon perceiving the odor of peanuts, but many of us, in this country, have formed the habit of thinking of the two at the same time or in immediate succession. All this simply shows that the connections between ideas and perceptions or other ideas, like other kinds of habits, depend directly upon what experiences we have had.

No individual's experience is exactly like that of any other individual, and for that reason we may expect him to have formed associations which would not be present in other individuals. If the idea of cherries reminds me of a certain camping trip, it is because I once earned the money required for that trip by picking cherries. Not many other people would be reminded of a camping trip by cherries, and it is very doubtful whether anyone else would be reminded of this particular trip. But associations of this individual sort are not nearly so frequent as we might suppose. The thought of boy reminds me of girl, the thought of snow reminds me of cold, the thought of lamp reminds me of light. While these associations, just as truly as the one between cherries and a certain camping trip, are habits formed as a result of definite past experiences, they are associations which are widely prevalent. They are the result of experiences which are duplicated in the life of almost everyone.

There is a very interesting experiment, called the free association experiment, which throws light upon the relative

frequency of associations peculiar to some individual and of those possessed by almost everybody. A list of one hundred simple words, such as "man," "house," "grass," and the like, is employed. A subject in this experiment is given one of these words. He thereupon responds with the first word that occurs to him. Then he is given another word, and so on through the list. It has been found that most individuals respond to by far the greater number of these so-called stimulus words in a way that one would naturally expect. For example, over six hundred out of one thousand subjects were reminded of light by the stimulus word "lamp."

Classification of associations. — Among the more common associations are those between items that are related in some logical manner. The relations involved, it should be noted, are relations between what the associated ideas stand for or represent rather than between the forms of the perceptions or ideas which are associated. For example, snow and white are commonly associated, and they are also logically closely related. White is an attribute or characteristic of snow.

Ideas are associated when they stand for *similar* things, *contrasting* things, things related as *wholes to parts*, things related as *cause and effect*. These are just a few of the logical relations important in the association of ideas.

The strength of associations. — The perception of the word "boy," or the idea of boy, may arouse the idea of girl. This would take place, at least sometimes, for most English-speaking people. And yet it is extremely doubtful whether there is anyone for whom the idea of girl is the only idea associated with boy. The idea of boy may arouse in the same individual, though of course at different times, the idea of David Copperfield, of the old swimming hole, of the purposes of education, and of an orphans' home. In the

light of this, it is necessary for us to inquire why, at any particular time, one association is stronger than the rest.

When there is associated with a given perception or idea a number of other ideas, the first of these associations to be formed has a certain advantage by virtue of that *primacy*. Other things being equal, the name "Thomas" is likely to arouse an idea of the first person of that name I ever knew.

The latest idea associated with a given perception or idea also has an advantage by virtue of that *recency*. Other things being equal, I am likely to think of the person by the name of Thomas whom I have most recently met.

The idea most frequently aroused by a given perception or idea has an advantage by virtue of that *frequency*. If I have used the name "Thomas" very frequently in connection with a certain person, I am likely to think of that person when I hear or think of that name.

The idea associated with a given perception or idea has an advantage if it has been aroused by that perception or idea under circumstances of great *vividness*. If a man by the name of Thomas had once defrauded me out of a fortune, the sound or idea of the name would probably arouse the idea of that man, even though other Thomases had been known earlier, later, and more frequently.

Which of a number of associated ideas is aroused at a given time depends upon the general *frame of mind* one is in. If I am, at the moment, concerned about the British novelists the word "boy" is likely to arouse an idea of David Copperfield or Oliver Twist. If I am suffering from the heat of a summer day, it is likely to arouse an idea of the "old swimming hole." If I am meditating on the future of the human race, it may arouse ideas of the purposes of education. If I am in a charitable frame of mind it may arouse an idea of an orphans' home.

D. Concepts

Ideas are associated together into groups or concepts. — In Chapter III we showed that simple habits of movement, simple intellectual habits, and simple habits of feeling are incorporated into larger systems of habits. A system of ideas, or intellectual habits, is known as a *concept.*

All of the ideas pertaining to birds which can be aroused in me make up my concept of the class of animals called "birds." All of the ideas pertaining to justice which can be aroused in me make up my concept of justice. All of the ideas pertaining to Lincoln which can be aroused in me make up my concept of Lincoln.

If the idea of spring occurs to me, it is likely to arouse ideas of baseball, violets, fishing, or poetry. The idea of violets, on the other hand, is likely to arouse the idea of spring or one of the less general ideas, such as poetry, which are closely associated with spring. Now, it is in the process through which one idea recalls another idea, or perhaps a whole group of other ideas, that we are able to discover the systems into which ideas are organized. When I am not speaking or thinking of spring, there is nothing which anyone could observe to suggest that in me spring stands for a complex system of interrelated ideas.

There is another less direct manner in which these systems, or concepts, reveal themselves. Flying certainly is not an element in my concept of dogs. If someone says, "Dogs fly," I reject that statement as false. And it is a striking fact about that act of rejection that I do not have to stop and think about the dogs I have known and their inability to fly before putting the proposition aside as absurd. The mere idea of dog, without arousing any associated ideas, simply will not lie down in peace beside the idea of flying.

My rejection of the proposition that dogs fly takes place just as it would if I consciously took into consideration all of the ideas associated with the word "dog." Although there is nothing in the mere sound of that word to indicate that it does not belong with the word "fly," nevertheless its action is apparently determined by all of the ideas that could be aroused by it. If someone says, "Dogs bark," I accept it in the same immediate way in which I reject the statement that dogs fly. I show in my action the influence of the ideas connected with dog, though those ideas do not actually occur at the time of my acceptance of this statement. Thus, the way the word or idea, "dog," combines or fails to combine with other words and ideas reveals a whole system of ideas, that is to say, a concept, to which the word or idea, "dog," belongs.

Concepts may represent concrete objects or abstractions. — The building in which I live is a single, definite object. Although it consists of many parts, such as cellar, walls, roof, windows, doors, halls, and has many characteristics, such as size, location, color, age, it is still a unitary object. Its parts and characteristics are incorporated into an actual unit which is susceptible of immediate and direct observation. Now all the ideas that represent parts and characteristics of this building, as well as the idea representing the building as a whole, are organized into a concept.

We may draw a contrast between such a concrete object as a particular house and such an abstraction as mankind. There are many actual men, many kinds of men, and many human characteristics. But the whole which is constituted by the many actual men, the many kinds of men, and the many human characteristics is not, itself, an object which can be directly observed. Mankind is an abstraction. To each of us it stands for the total organization of our ideas

about men, but it has no single concrete object as a counterpart. Many of our concepts, or systems of ideas, are of this sort. Many of the ideas making up the system represent concrete, observable objects, but the system itself does not stand for any one concrete thing.

The highest achievements of the human mind depend upon the existence of abstract concepts. Such geometrical concepts as the straight line, the square, and the triangle do not represent single, unitary objects. The straight line of geometry is not one straight line and it is not all the straight lines in the world put together. It is any straight line. The square is any square, and the triangle is any triangle.

How impossible it would be to deal efficiently with space if we had no concept to represent straight lines in general, if we had only ideas of particular straight lines and their special characteristics — their particular lengths, locations, and the like! Such concepts as loyalty, patience, and honesty represent similar abstractions. Loyalty is any loyalty, from that of the dog to his master to that of a statesman to his country. Patience is any patience, from that of a child awaiting dessert to that of a young physician awaiting recognition and a practice. Honesty is any honesty, from that of a boy abstaining from the theft of an inviting apple to that of a broker giving his clients sound advice. If it were not for concepts of virtues in the abstract, effective moral education would be all but impossible. Loyalty would have to be taught from the beginning in each new situation. As it is, a child who learns in a few concrete situations that one who trusts him deserves his loyalty has a general notion of loyalty which enables him to recognize loyal actions even in situations in regard to which loyalty has not previously been considered. He comes to recognize a place for exercising loyalty as readily as he would recognize

a triangle, even though he had never seen this specific triangle before.

Concepts of concrete objects and concepts of abstractions depend upon each other. — It would be impossible to have anything like a true concept of mankind, an abstraction, without having at the same time fairly elaborate concepts of such concrete objects as individual men. The ideas of human traits, for example, which are important elements in any adequate concept of mankind, grow out of our experience with concrete, actual persons. The human race is and has been made up of poets, peasants, soldiers, statesmen, merchants, and inventors, but more than ideas of the names of these groups is required. It is necessary to know, or know about, some individual poets, to have an organized system of ideas about each one; to have, in other words, a concept of each one as of a concrete, actual person. Otherwise, the idea of poets could have no more meaning than a mere name and, in that case, it could add little to our concept of mankind. In order that an idea enter into and play an important part in an abstract concept, it must also be part of a concept of some concrete object.

It is possible and often desirable to form an abstract concept of such a business institution as the bank, before we have had the opportunity to acquire many ideas about particular banks. But an almost wholly abstract concept of this kind is seldom if ever very accurate or complete. Its usefulness consists in the fact that in this concept we have a framework or setting for the more detailed and specific ideas which practical experience is later to furnish. One who enters the banking business with a general, theoretical notion of what it is all about is not so likely to be swamped by the mass of detailed facts which he must master. The detailed operations of a single bank would not be mastered readily by

a person devoid of some conception of the general purpose and plan common to all banks. In fact, one can scarcely be said to be in a position really to understand the working of a single bank, if he has not a general idea (an abstract concept) of the business world as a whole. A skilled banker must know more than the internal details of his bank. He must know the general principles of business so well that he can pass quick and accurate judgment on the affairs of a wide variety of business men who wish, perhaps, to borrow money from him.

Words are essential elements in concepts. — As we have elsewhere remarked, a given concept may play a definite part in our thinking without our being actively aware of all the ideas making up that concept. Any idea which is a part of my concept of dogs may show, in the way in which it combines or fails to combine with other ideas, that it is influenced by the general system of which it is a part. It is because of the relationship of the word "dog" to a whole system of ideas that I so promptly reject the statement, "Dogs fly." If I were to stop to recall all of my ideas about dogs, I should hardly be any surer of the fallacy of the statement than I am upon its first inspection. The word "dog" thus stands for or represents a system of ideas, a concept, of which it is a part. A word, acting in this way, is said to symbolize a concept.

It is not only words that are able to symbolize, stand for, or represent whole concepts. Any idea involved in a concept does to a certain extent represent, in the way it acts, the concept as a whole. But there are a number of reasons why words are especially effective concept symbolizers.

The simpler sorts of thinking and communication are concerned for the most part with concepts of concrete objects and events. Mental images for private thinking,

and gestures and pictures for the communication of thought, do fairly well under such circumstances. But as mental life becomes more highly developed, and as concepts become organized about abstractions, we find that images, gestures, and pictures become too clumsy and inaccurate to constitute any longer the principal forms of thought. Let us suppose, as is very often the case, that a child's father and his father's various characteristics are the first elements involved in the child's concept of man. While his concept is in that stage, a visual image of his father may serve as an accurate symbol. But as experience extends the concept so that it includes ideas of tall men and short men, black men and white men, fat men and thin men, a visual image of his father will prove a less and less satisfactory symbol, even for the purposes of his private thinking. His concept has come to mean any man, but the visual image of his father pertains more to one particular man than it does to all the others. It is conceivable that under very simple conditions of life all one's ideas of going might pertain to going by foot — to walking or running. If this were so, the concept of going might be perfectly well symbolized by a visual image of a man walking or running, or, in case the thought were to be communicated, by the posture of walking or by a picture of an individual walking. But as modes of locomotion increase, such forms of thought become too special in their reference.

The greater the number and diversity of the ideas that become incorporated into a concept, the more necessary it is to have some method of symbolizing the whole concept without special reference to one of its elements. As means of going multiply, it becomes more and more confusing to let an idea pertaining especially to one mode of going stand for going in general. Now it is especially in the case of the

more complex, elaborate, and abstract concepts that words, as symbolizers, become indispensable. The word "going" stands equally well for any method of going and is not likely to become confused with particular methods of going. Similarly, the word "man" stands equally well for any man and, once the child has acquired it, he is less likely to confuse "any man" with the particular man who is his father.

Any idea which is a part of our concept of justice may represent the entire concept. For example, a visual image or a picture of a balance is often employed to symbolize justice. It would be very awkward if, whenever we thought of justice, we had to do so in terms of this image, and if, whenever we wished to communicate the idea of justice to others, we had to draw a picture of a balance. But what other idea involved in this concept would be as good a symbol? We are at once forced to admit that few of these ideas would serve at all well as a symbol of the whole. Justice is not made up of concrete objects which, in ideation, are represented by simple images or other simple forms of thought. Justice is always a quality of fairly complex actions, any one of which can be thought about adequately only by means of a series of ideas. Justice is a quality which a judge's decisions are supposed to have, but each of those decisions is a complex, elusive affair. Fortunately, we have the relatively simple word "justice," and it saves the day, so far as utilizing this concept in our thinking is concerned. The audible or, if we are thinking privately, the inaudible pronunciation of this word brings to bear upon the course of our thinking much of the elaborate meaning which justice has for us.

So elusive and complex are the ideas incorporated in many concepts, that if it were not for some simple words to symbolize them, we should hardly be able to use the concepts at

all. It sometimes seems that the introduction of a word or other language symbol, such as a written or spoken number, brings together into one well-unified system ideas which had formerly been only vaguely related to each other. The development of arithmetic was long retarded because men lacked any well-organized conception of zero. Their ideas corresponding to the different aspects of this abstraction were not organized, and they could not use the concept in their thinking because the concept did not exist. But finally they introduced a character in their number system to symbolize all the ideas they had about zero, and straightway they had a concept indispensable for successful thinking about quantities.

Words facilitate communication. — Words enable people to think together. They are not only symbols which make it possible for us to think of abstractions and combine many ideas into a single concept. They furnish the means whereby ideas and systems of ideas can be communicated. Even those ideas that represent the most concrete of the objects about us are more easily transmitted from one person to another when they take the forms of spoken or written language. Gestures and pictures are as awkward for social intercourse as they are for private thinking. Consider having to go through the motions that would be required for an accurate account of a football game that you had witnessed! Think of the pictures that would be required if you wished to impart this description to some friend a thousand miles away!

One special virtue of vocal communication, as contrasted with that carried on by gesture, lies in the fact that talking can go on while one is using the legs and arms for other purposes. Another advantage is that people can converse around a corner, through a wall, and in many other positions

in which they are not mutually visible. They can also talk in the dark. This is not such an important fact for us who live in a land of electricity, but under more primitive conditions of life the ability to use words in place of gestures for conveying ideas might easily be vital. A third advantage of the spoken word is the small amount of energy required for its production.

Modern civilization is dependent upon written language.— Really rapid strides in the building of the modern, civilized world were not made until written language came into general use. The experiences of a man living at one time and in one region are, compared with the experiences of the men of many ages and many regions, relatively few. Now we have seen on frequent occasions that what a man is and does depends to a great degree upon what he has learned from experience. Anything, then, that could give one man the experiences of men of other times and countries should increase that one man's powers tremendously. And that is just what written language does. One man can master a field of science which it has taken the experience of hundreds of men to produce. One man can master the lessons in government, politics, and business which only the varying fortunes of races of many times and countries could teach directly. One man can do all of this simply because it is possible to record wide ranges of experience within the covers of a book.

Before writing became possible (and that was a long time ago, because in very ancient times men had already begun to record their experiences on stone tablets), the lessons learned by one man had to be passed on by word of mouth to his descendants and to those contemporaries who were not close to him. Information circulated in this way would naturally be modified severely, if it were not constantly checked up,

and such checking was frequently impossible. If a traveler returned from a trip of exploration in a distant land, his own account of what he saw might be accurate enough, but as the story spread from one town to another and from the fathers to the sons, memories would be certain to fail and imaginations would be certain to fill in the lost details, until finally hardly a true fact remained. But now, with modern printing, the most accurate records of events can be passed out to the ends of the earth and preserved for long periods of time. The fact cannot be overlooked that the printed page may carry statements as fictitious as a folk tale, and that many people have too great a confidence in what they see in print. Still, none of us would be willing to give up the printed page and all that it has done for us, and most would hold that it has passed on much more information than misinformation.

Summary of the Chapter

1. Ideas are activities. While they may represent objects they are not, themselves, objects.

2. In that form of ideation known as imagery one has an experience very like sense perception, except that it is usually less definite and that the object represented by the ideation is not really acting upon the sense-organs at that time.

3. The belief is often held that thinking about objects which are usually seen demands visual imagery, and that thinking about objects usually heard demands auditory imagery. This is not, however, anything like a general rule. A landscape one has seen *may* be thought of quite accurately in terms of words. We should take care in this connection to avoid confusing the form of our thinking with what that thinking is about.

4. Ideation very often occurs in the form of the spoken and written word and often, too, in the form of inaudible speech. Words as written and as uttered aloud or to oneself are not mere expressions of ideas. More often than not they are, themselves, ideas. Sometimes, of course, the words occur in the form of auditory or visual imagery.

5. Movements other than those of speaking and writing may function as ideas. Thus, gestures are ideas, and so, under certain circumstances, are bodily postures.

6. Like other forms of acquired activity, an idea may become so automatic in its occurrence that we are unable to detect its form.

7. Although the forms or structures of ideas are interesting, what the ideas represent is of still greater consequence.

8. Ideas represent both the past and the future. They also represent experiences which the thinker has never had and is never likely to have.

9. History, the sciences, and other bodies of knowledge upon which civilization depends are collections of ideas. This does not mean that ideas are literally stored up, either in books or in anybody's mind. What the individual retains is a capacity for ideation, and what the book holds is a capacity for arousing ideational activities.

10. Most, though not all, of our ideas, are related in a fairly definite manner to our subsequent overt actions. In fact, ideas are frequently nothing but preparations for such completer actions.

11. There are two senses in which ideas are acquired forms of activity. In the first sense, images, postures, movements, come to represent certain objects and events only as a result of experience. In the second sense, the conditions under which ideas occur are determined by experience.

12. As a result of experience, we develop what are known

as *associations* of ideas. That is, certain ideas tend to be aroused upon the occurrence of certain percepts and other ideas. These associations are usually thought of as successive percepts and ideas. They may also exist between percepts and ideas occurring simultaneously. Since some experiences are peculiar to an individual, some associations are also peculiar to him. Since some experiences are shared in by large numbers of individuals, some associations are common to large numbers. These common associations are usually between ideas of logically related objects.

13. When we have associated with a given perception or idea a number of other ideas, the question arises as to what determines the strength of these various connections. These factors can be enumerated as primacy, recency, frequency, vividness, and temporary frame of mind.

14. Ideas are organized into groups or concepts. The ideas belonging to any concept are closely associated with the other ideas belonging to that concept. Furthermore, an idea belonging to a given concept shows, in its tendency to combine or fail to combine with other ideas, the influence of other ideas within the same concept.

15. Concepts may represent concrete objects, such as a particular house or person, or they may represent abstractions, such as the straight line of geometry. Both types of concepts are valid and necessary for effective living. And in their development each type depends upon the other.

16. Although any idea belonging to a concept may, strictly speaking, stand for the concept as a whole, words have a special advantage as symbols of concepts. They are able, as is no other element in a concept, to represent the whole of the concept without undue emphasis upon one or a few of its constituent parts.

17. Often a concept cannot play a definite part in our

thinking until there is a word to stand for it. Words also make possible the communication of ideas and concepts and, in written form, the preservation of them.

PROBLEMS

1. Imagery is especially likely to be mistaken for perception in dreams of sleep. Can you see any reason why that should be so?

2. How is a person's thought affected by the size of his vocabulary?

3. Under what circumstances is a bodily movement an idea? Illustrate by giving a case of bodily movement that is an idea and another case of bodily movement that is not an idea.

4. Examine one by one each of the ten items in the list below. Think about each of the items, and then write a full account of the form of your thinking? Which ideas were in the form of images? What kinds of imagery did you experience? Visual? Auditory? Any other kinds? Which of your ideas were in the form of words? Words spoken to yourself? Images of words? Which of your ideas were in the form of movements or bodily postures? Did you think about anything without being able to detect how you thought of it? What?

A red rose
A train pulling out of a station
Lightning striking a tree
Onions frying in a pan
Climbing a flight of stairs
A table set for dinner
A strong wind
A bite of chocolate
A cold shower
A band playing "The Star-Spangled Banner."

5. Why is it of minor importance for practical life whether a man's imagery is mostly visual or mostly auditory?

6. What is meant by the statement that ideas free us from the limitations of time?

7. State in your own words why the sciences and other formal bodies of knowledge are useful for human life.

8. Under what circumstances are movements most likely to be preceded by ideas of those movements? Illustrate.

9. Look at the first word in the following list and immediately write down the first word it makes you think of. Do the same for each word in

the list. The members of the class should bring in their lists of associated words. The instructor can write upon the blackboard the first word in the following list and then call for the associated word recorded by each member of the class. How many members have associated words peculiar to themselves? Which associated words were obtained by a large percentage of the class? Were these common associates logically related to the stimulus word? How? The other words of the stimulus list and their associates should be gone through in the same way.

1. table	4. comfort	7. white	10. carpet	13. blue
2. man	5. butterfly	8. foot	11. trouble	14. quiet
3. mountain	6. whistle	9. memory	12. boy	15. salt

10. To what extent did primacy, recency, frequency, vividness, and temporary state of mind determine your associates in the exercise given above?

11. Does each of your ideas belong to one or to more than one concept? Why do you think so? Illustrate.

12. Enumerate five relatively concrete objects and five abstractions other than those mentioned in the text.

13. When a small child, upon his first trip to the country, calls a lamb a dog, is this because his concept of "dog" is too concrete or too abstract?

14. Enumerate some concepts which we should have difficulty in utilizing in thought if we had no words to stand for them.

15. Show why language is vital for the carrying on of business: of government; of education.

REFERENCES FOR FURTHER STUDY

Galton, *Inquiries into Human Faculty and Its Development* (Everyman's Library), pp. 75–79; or *Readings in General Psychology*, Ch. XII, Selection 2, p. 294 ff.

Titchener, *Experimental Psychology of the Thought Processes*, pp. 7–11; or *Readings*, Ch. XII, Selection 3, p. 298 ff.

Galton, *Inquiries into Human Faculty and Its Development*, pp. 79–80; or *Readings*, Ch. XII, Selection 4, p. 300 ff.

Lewes, *Problems of Life and Mind* (3d. series), pp. 280–285; or *Readings*, Ch. XII, Selection 5, p. 302 ff.

Loveday and Green, *An Introduction to Psychology*, pp. 179–191; or *Readings*, Ch. XVI, Selection 2, p. 402 ff.

Höffding, *Outlines of Psychology* (tr. by Lowndes) pp. 172–173: or *Readings*, Ch. XVI, Selection 3, p. 409 f.

Tylor, *Anthropology, etc.*, pp. 114–117; or *Readings*, Ch. XV, Selection 2, p. 372 ff.

Judd, *Psychology* (revised ed.), pp. 219–233; or *Readings* Ch. XV, Selection 4, p. 380 ff.

Tylor, *Anthropology, etc.*, pp. 309–316; or *Readings*, Ch. XV, Selection 5, p. 383 ff.

Tanner, *The Child, His Thinking, Feeling and Doing*, pp. 332–335; or *Readings*, Ch. XV, Selection 6, p. 388 ff.

Slosson, *The Scientific Monthly*, 1923, 445–447; or *Readings*, Ch. XV, Selection 7, p. 390 ff.

CHAPTER X

MEMORY

A. Memorizing
B. Forgetting

Questions to Keep in Mind while Reading this Chapter

1. What facts determine the efficiency of memory?
2. Why do we forget?
3. What are the typical errors of memory?

Remembering anything is an ideational habit. — Ideas of my boyhood home, of the school I first attended, of companions of other days, of what I was doing at this time a year ago, of last Saturday's football game, in so far as they refer to what has actually existed, are memories. Not all thinking of the past is remembering. Ideas are memories only to the extent to which they represent what has actually been thought or experienced by him who has those ideas.

It is clear that ideas of the kind involved in memory, representing as they do the past as it has actually occurred in the personal experiences of him who remembers, are very definitely products of that past experience. In other words, they are acquired ways of acting, or habits.

Ideas of memory are produced either by actual happenings or by ideas. — Suppose that one looks, for the first time, upon a beautiful building. Suddenly he is given an urgent message and leaves the spot totally oblivious of what he has been seeing, so concerned is he with the contents of the message. But in some later, calmer moment he experiences

an idea of the appearance of the building he has seen. That is to say, he remembers it. Now, there is a psychological point here of no little interest. The idea of the appearance of the building was acquired through the actual perception of the building. The idea, itself, did not appear until some time later when the perceptual experience was remembered.

The ideas of memory may represent objects and events which have never existed for the individual who thinks of them, save in the form of ideas. Under such circumstances, it is not the objects and events, themselves, which may properly be said to be remembered. What are remembered are the *ideas about them*. When I think of events of the American Civil War, I am not remembering those events; they took place before my birth. Of course, in this case I may be remembering what I have read or heard about those events, but I cannot remember the events themselves. The ideas of memory, then, may originate either in actual objects or events, or merely in ideas of such objects or events.

While, so far as our memories for actual happenings are concerned, we are definitely limited by the bounds of personal experience, our intellectual life as a whole has a much wider range. This is clear if we but recall the discussion in the last chapter of how ideas put us in touch, not only with our past, but also with the future, and even with what it will never be possible for us to experience directly. The American Civil War, the discovery of this continent, the conquest of Gaul, the erection of the Egyptian pyramids, lie outside of our personal experiences. We cannot remember these events. Still, we can recall ideas about them, and these ideas often serve as well as first-hand experiences. Indeed, sometimes they are more accurate. No one man experienced directly more than an infinitely small portion of the Great War. Reliable information about that tre-

mendous, complicated event can be obtained only by putting together the experiences of many men. This, of course, can be done only through ideas, and it is these ideas which must be studied and remembered by the seeker after knowledge in this field. Much more is known by scholars today about mediaeval times than was known by any man then living. And yet all that is remembered of those times today is in the form, not of remembered events, but of remembered ideas.

A. Memorizing

Good memory depends upon a wise selection of what is worth memorizing. — Since memories are habits of a special kind, many of the principles that are important in the acquisition of other kinds of habits will apply to memory as well. Any habit tends to become fixed if it is often repeated, and memories are no exceptions to this rule. But the effects of repetition, as has been pointed out, may be bad as well as good. Repetition of a faulty stroke in tennis may establish a habit that will forever stand in the way of its owner becoming the expert he might have become if the faulty stroke had been given less practice. If, in memorizing, one rehearses all the elements in the material to be mastered without regard to their importance, he is also likely to get into trouble. Perhaps spending so much time on trivial facts leaves too little time for what is important and, consequently, nothing about the subject in question is known really well. Or perhaps so many facts are memorized that one is later unable to get at the important facts without also recalling the unimportant. A good illustration of this latter type of difficulty may be found in the following quotation from one of the novels of Jane Austen.[1]

[1] Quoted by James, *Psychology*, Vol. I, p. 571; also by Breese, *Psychology*, p. 260.

Notice how important and unimportant facts are undistinguished in the memory of Miss Bates, the fictitious author of the following speech:

> "But where could *you* hear it?" cried Miss Bates. "Where could you possibly hear it, Mr. Knightley? For it is not five minutes since I received Mrs. Cole's note — no, it cannot be more than five — or at least ten — for I had got my bonnet and spencer on, just ready to come out — I was only gone down to speak to Patty again about the pork — Jane was standing in the passage — were not you, Jane? — for my mother was so afraid that we had not any salting-pan large enough. So I said I would go down and see, and Jane said: 'Shall I go down instead? for I think you have a little cold, and Patty has been washing the kitchen.' 'Oh, my dear,' said I — well, and just then came the note. A Miss Hawkins — that's all I know — a Miss Hawkins, of Bath. But, Mr. Knightley, how could you possibly have heard it? for the very moment Mr. Cole told Mrs. Cole of it, she sat down and wrote to me. A Miss Hawkins — ."

No one would remember the past in all its insignificant detail if he had distinguished between the insignificant and the significant at the time those past experiences occurred. People with memories like that of Miss Bates are people who get just as excited over a broken chair as they would over a broken leg. Many students complain of the difficulty of a textbook they are studying, when the real trouble lies in the fact that they read it, as Miss Bates went through her daily life, with never a thought as to what is important and what is of lesser consequence.

Wise selection demands perspective. — Suppose that one wished a thorough knowledge of New York City, and suppose that he set out to visit every street in that vast city. How would his knowledge thus gained compare with that of another who had gone to the top of the Woolworth Building

on a clear day and secured a bird's-eye view? Certainly the man who visited hundreds of individual streets would collect a large amount of detailed information, some of it important and some of it unimportant, which no amount of gazing from the Woolworth Building would furnish. On the other hand, a relatively large amount of what is seen from the Woolworth Building is important for understanding the city of New York. The shape of Manhattan Island, the positions of the bodies of water about it, and other facts which the observer on the Woolworth Building would be sure to notice at once are all of first-rate consequence. Of course, the ideal method of securing knowledge about New York City would be to combine these two methods. First it would be well to have the bird's-eye view; or perhaps a look at a map would do as well. The information secured from this perspective would serve as a guide for more detailed investigations. Any general reading about the city, its history, its industries, its social life, would add to the perspective and make one better able to decide what individual spots were most worth visiting.

In studying a short article or even a long book, it is as necessary to secure a bird's-eye view as it is in studying a city or a piece of machinery. A student was once taking an advanced course in psychology under a famous professor. The text used was a large volume of about six hundred pages. One day during the third week of the course, the professor casually asked the class how many of them had read the text through. Out of something like one hundred students only one or two had done so. Upon learning of this state of affairs, the professor proceeded to deliver a vigorous protest. He knew that those who had not first made a rapid reading of the whole book could have no basis for estimating the importance of the daily lesson and its relationship to other

lessons. A student mastering ten or twenty pages a day is likely to treat each assignment as a unit in itself and as of the same importance as any other assignment. Now, the careful study of a textbook, or of any other important volume, demands that we take the larger task a step at a time. And the very rapid reading of such a book can give us only the haziest sort of an idea of the details of the subject it treats. But what the rapid reading can do is to give us a perspective, an idea of what, in general, the discussion is about, so that our study of details will have some basis for being selective.

A general idea, or perspective, of a subject we are studying will do more than reveal what is and what is not worth remembering. It will make it easier to remember what is most worth remembering. In the preceding chapter we pointed out that a man who has general ideas of banking will pick up the details of a particular bank much more readily than he would if he had not those general ideas. The general ideas act as a kind of framework into which the details seem logically to fit. Let us say that a minor clerk in a bank is confronted with the fact that interest is paid on all savings accounts but not on all checking accounts. If he already knows the general fact that banks make profits by investing deposits, he will have no difficulty in remembering the difference between savings accounts and checking accounts. Knowing the general principles of banking, he not only observes the fact that the two kinds of accounts are treated differently, but he knows *why* they are treated differently. And knowing *why* a fact is so is a great aid to remembering that fact.

Ability to memorize depends upon what we already know. — In Chapter IV we pointed out that the ease with which new habits are acquired depends upon what habits are already possessed. This is true of memory habits as well as

of other kinds of habits. The baseball fan has no trouble remembering that the batting average of a certain favorite player is in the neighborhood of .380. Yet he may have considerable difficulty in memorizing the fact that 460 is the telephone number of his business partner. There are several facts which he already knows that make it easy for him to remember the batting average. In the first place, he knows that this favorite player is an excellent batter. In the second place, he knows that excellent batters are those whose averages range ordinarily between .300 and .400. In the third place, he knows that this player has shown a great improvement since two months before when his average was around .280. And there are reasons why the business partner's telephone number is less easily remembered. There is nothing about the partner, his family, or where he lives to help one remember that his telephone number is 460.

One of the most astounding things about business men, professional men, and scholars is the number of facts along their own lines of work that they have at their immediate command. A mere glance at a news item about something related to their work is sufficient to establish an idea that will not be forgotten, perhaps, for years. When information about a business, a profession, or a period in history once begins to accumulate, it acts like a little snowball rolled in damp snow. The more that is known, the more likelihood there is of new facts being remembered.

It is not true, however, that the acquisition of any kind of new knowledge is facilitated by all of what one already knows. If the new knowledge is practically unrelated to what is already known, our established knowledge will neither aid nor hinder in any important degree the learning in question. Indeed, situations arise in memory, as they do in regard to other acquisitions, where established habits interfere

with learning. If a business man has carried on his work in a set manner for a great many years, he is not likely to remember for long the new methods about which he hears. Let us say that some time ago one was introduced to a Mr. James, but that the name was misunderstood at the time of the introduction and that, for several weeks, one has thought of the new acquaintance as being a Mr. Jones. When attention is finally called to the error, the name "Jones" may be so firmly associated with the man that it is all but impossible to memorize his correct name. This interference which old knowledge sometimes exerts on the establishment of new memories is called *associative inhibition.*

Facts are readily memorized if in line with our interests. — The fact that a feeder of live stock commits to memory quickly and with little apparent effort current prices offered for steers of various grades is due to more than a mere knowledge of how such prices usually run. Such knowledge does increase what we might call the memory value of the figures; but there is another matter of considerable importance, and that is the fact that the stock feeder is very much interested in steer prices. He may not spend any more time studying them than many other people, but, being so interested, he pays exceptionally close attention to them. And everyone knows that memorizing is most efficient when close attention is paid to what is being memorized.

In actual life, interest and previous knowledge work hand in hand in facilitating memorizing. Without wide knowledge of a subject, interest in it is not likely to be strong. On the other hand, nothing aids the accumulation of knowledge more than interest. The business man, the professional man, and the scholar learn readily what pertains to their work because of their interest as well as because of knowledge already acquired.

Rote memorizing is often necessary. — In early childhood, much that is memorized must be fixed by sheer force, that is, by repeating it over and over again. The learning of the multiplication table is an example of what is called *rote memorizing.* In teaching the multiplication table, some appeal can be made to a child's interests and established information, but the main thing is to secure plenty of repetition. As we grow older, our intellectual background becomes broadened, and most of the facts that we are called upon to learn seem to fit fairly logically among the facts already known. When these logical relationships can be utilized, we speak of *logical memorizing.*

Many persons, realizing how many facts they learned by rote during childhood and also having in mind how little they learn in that manner now, believe that children have better capacities for rote memorizing than adults. It is sometimes held that certain habits, such as the accurate pronunciation of a foreign language, cannot be so well acquired by adults as by children. If this is true, it is probably attributable to the greater strength of competing or antagonistic habits in adults. In general, adults are quite as capable as children, and perhaps more so, in rote memorizing. But adults are so used to mastering facts by logical memorizing, that is, by bringing them into relationship with their interests and established knowledge, that we might almost call them spoiled. Logical memorizing is so much superior, so much easier and more efficient, where it can be applied, that adults are prone to become impatient in the face of material which cannot be memorized in that way.

No one is ever so well informed that everything he needs to memorize fits logically into the rest of his knowledge. No one ever escapes the need of a certain amount of rote memorizing, and the fact may as well be faced. Logical

memory will take care easily and accurately of the gist of an article or poem which it is necessary for us to retain, but only the repeated rehearsal of it will make us sure enough to warrant indulgence in verbatim quotations. A physician, who learned his prescriptions by merely glancing at them and trusting that, because of their relationship to his other knowledge, he would be able to recall their general characters, would be sure to make grievous errors. A prescription should be exact to the last detail, and the only way of being sure of accuracy of this order is to repeat and repeat and repeat what is to be remembered until it is known as well as the fact that two and two make four.

Occasionally it is well to learn by rote, simply as a matter of convenience. A certain scientific investigator makes frequent use of a number of mathematical formulas. He could, without much effort, remember the general principles of these formulas, because they fit naturally into the rest of his knowledge. But he could not make actual use of the formulas simply by knowing their general principles. He would always have to refer to some manual where they appear in exact form. In order to save himself the constant task of looking up the formulas he has taken the pains to memorize them in detail, which is, of course, largely a matter of rote memory.

The intention to remember is important. — A certain business man had often complained of his poor memory for people's names. Upon seeing a person whom he had met once or twice before, he would almost invariably recognize the person as someone whom he had met — he might even remember where and under what circumstances the meeting had taken place — but almost always he was unable to recall the person's name. One day we were carrying on an experiment in the laboratory and we invited this man, whose

memory for names was so poor, to take part in it. The experiment consisted of two parts. In the first, the subject was told that he would be shown a number of photographs of men whom he had never seen before; that attached to each picture was a name, and that as the pictures were shown, one by one, he was to observe them and their attached names so carefully that afterward, upon being presented with the pictures, he would be able to name them correctly. The second part of the experiment was similar, except that actual men, with whom he was unacquainted, were introduced to the subject, their names being announced after the fashion customary in introductions. But here is the important point! Although a large number of subjects took part in this experiment, the man who had always complained of his poor memory for names remembered more names correctly in both parts of the experiment than did anyone else. This set him to thinking. Evidently his failure to remember names of people met in actual life was not because of a naturally poor memory. Then he recalled that, in meeting people, he gave attention to their appearance and what they had to say, but that he never paid attention to their names or formed any conscious intention to remember their names. In the experiment, of course, he *did* have a conscious intention to remember. Later he tried out in actual life the method he had employed so successfully in the experiment, and today he is seldom embarrassed by failing to remember some name which he should be able to recall.

Where objects or events are full of meaning or emotionally stimulating, we are likely to memorize them without realizing that we are memorizing. The fact that the earth is round is so full of meaning, even for the child who hears it for the first time, that he does not have to form a conscious intention

to memorize it. The occasion of being graduated from high school is exciting enough to remain remembered throughout life without one's making an actual effort to remember it. But wherever the material to be learned is comparatively lacking in meaning or emotion-arousing qualities, the intention to remember plays an important rôle. We have just had an instance of this in the case of remembering people's names. Two other interesting examples are cited by Professor Woodworth:

> There is a famous incident that occurred in a Swiss psychological laboratory, when a foreign student was supposed to be memorizing a list of nonsense syllables.[1] After the list had been passed before him many times without his giving the expected signal that he was ready to recite, the experimenter remarked that he seemed to be having trouble in memorizing the syllables. "Oh! I didn't understand that I was to learn them," he said, and it was found that, in fact, he had made almost no progress towards learning the list. He had been observing the separate syllables, with no effort to connect them into a series.
>
> Another incident: subjects were put repeatedly through a "color naming" test, which consisted of five colors repeated in irregular order, the object being to name the one hundred bits of color as rapidly as possible. After the subjects had been through this test over two hundred times, you would think they could recite it from memory; but not at all! They had very little memory of the order of the bits of color. Their efforts had been wholly concentrated upon naming the bits as seen, and not in connecting them into a series that could be remembered.[2]

It is just as well that relatively meaningless material is not likely to be remembered unless we intend to remember it.

[1] These nonsense or meaningless syllables, such as zig, fud, bix, are frequently used by psychologists in experiments on memory. — E. S. R.

[2] *Psychology*, pp. 346–347 (Henry Holt and Company).

One of the difficulties with the memory of Miss Bates, whom we discussed, was that she remembered too many unimportant facts. She seemed unable to exercise the choice, which fortunately most of us can exercise, as to what should be remembered.

Recall during memorizing is advantageous. — After an examination in which he had done badly, a student called to tell his troubles to his instructor. He could not understand why he had failed. He told how many hours he had spent reading his text and lecture notes just before the examination and during the preceding weeks. The amount of time he had devoted to study was quite ample to have enabled a man of his intelligence to make a high grade. But a little inquiry showed clearly that his method of study was bad. He had, it is true, read and re-read the material to be mastered, but he had not practiced recalling it. His method, in other words, was passive rather than active. If immediately after reading a chapter in his textbook, or the notes of a lecture, he had made a conscious effort to recall as much as possible of what he had been over, he would have fixed this material in memory much more strongly. If he had gone further and, every few days during the course, allowed his mind to run back over the lectures and readings which he had been through since the course began, he would have fixed the essential facts even more firmly. What he failed to realize was that the mind, when confronted with a printed page, does not passively soak up the facts upon that page as a blotter soaks up ink. The facts need active mental handling before they will become well fixed, and one of the most advantageous methods of handling them is to practice their recall.

We have on several occasions noted the ease with which professional people memorize facts related to their work.

This is partly because such facts fit logically among the other facts they know, partly because, being especially interested in such facts, they give them careful attention, and also partly because they tend to recall such facts in the course of their ordinary thinking. It is sometimes said that the best way of mastering a subject is to try to teach it. The teacher who is called upon to explain his subject to others and to answer questions upon it is naturally engaged in an almost continuous process of recalling.

There are at least two reasons why recall is an aid to memorizing. In the first place, while one is actively trying to recall, his attention has little chance to wander. We are all familiar, however, with the strong tendency of the mind to wander from the printed page, especially if we are re-reading it. In the second place, the attempt to recall facts which we wish to memorize often reveals important gaps in our knowledge. When such gaps are found, it is possible, during further study, to emphasize the points about which our memories are uncertain.

How should study time be distributed? — For memorizing, as for habit formation in general, the proper distribution of time is of prime importance. It is impossible to state the exact manner in which study time can best be distributed. It *is* possible, on the other hand, to state what should be taken into account in regulating study.

1. The single study period should not be continued far beyond the point where boredom and fatigue appear. When we begin to be fatigued or bored by one subject, we can often turn to other work of a different character and put in our time to better advantage on it. If we force ourselves to study too long after we are bored and fatigued, we are in danger of establishing a distaste for the subject. Still, this does not mean that we should coddle ourselves. One unused

to study is prone to be quickly bored, if not fatigued, by it, and the only way for him to harden himself is to disregard the first discomforts that come from studying. Soon he will no longer notice them. But there is, for the best adapted worker, a point beyond which it is worse than useless to go on studying without a pause for rest, or without at least some temporary change in occupation.

2. The single study period should be long enough to bring one to a logical stopping-place. We have previously considered how important it is for efficient learning that we get a perspective or bird's-eye view of what we are studying. In actual practice it is not often possible to take in a subject during a single period of study or observation. The student of American history or commercial geography cannot get a unified view of his subject during one period of study. But he can see to it that each period of study covers one or more complete parts of the subject. If, for any reason, he puts aside his book just as he has reached the middle of a chapter, it will be well for him, upon later resuming study, to glance back over the half of the chapter already covered and to make sure that he recalls what it is about. Then he can safely proceed to finish the chapter without fear of losing his perspective of the chapter as a whole.

3. The periods of study should not be too widely separated. Otherwise forgetting will take place and each study period will have to be given over in part to the recovery of lost ground.

Cramming is justifiable if its dangers are recognized. — There is no sin, although it is often said that there is, in studying for a long period in preparation for an examination or for any other occasion where one's knowledge is to be put to a severe test. In fact, it often takes cramming to reveal

the subject as a whole and the interrelations between its parts. The desirability of a hasty, preliminary reading of a whole book, the parts of which one is going to study in some detail, has been indicated before. The final going-over which an entire course of study receives during a period of cramming has similar and, perhaps, greater advantages. Not only does it give a bird's-eye view of the course, but it is capable of filling in the details in a way that a preliminary reading, because of its very nature, could never do.

Cramming has, it is true, certain dangers against which it is well to guard. Too long and concentrated a period of study just before an examination may produce more fatigue than knowledge. This is likely to happen, though, only when all ordinary precautions are disregarded. A good many consecutive hours of study can be put in without any such unfortunate result. It is true that a nervous person or one otherwise in poor health or of naturally delicate constitution has to be more careful.

Another danger of cramming is that, after discovering what an astonishing amount can be learned during a concentrated period of study, one may come to depend entirely upon that method of learning. There are in the neighborhoods of some universities so-called tutoring schools. These tutoring schools can take men who have not looked at a book during the college year or semester and, by carefully guiding their cramming for a week or so, enable them to pass their examinations with little difficulty. Reliance upon such a method of learning is unwise, for a number of reasons. In the first place, it is likely to encourage general habits of procrastination. In the second place, leisurely thinking about a subject is necessary if we are to appreciate its many ramifications and relations to life at large. Where cramming alone is relied upon, there certainly is no opportunity for

leisurely contemplation. In the third place, although the results of cramming may carry one successfully through an examination, what is acquired in this process will not be remembered for any length of time. More leisurely study makes for longer remembering, probably because of the fact that under such circumstances the subject is related in more ways to what was previously known and to everyday life.

But it is well to recall again that it is not cramming itself that is to be avoided, but only excessive cramming and too complete a reliance upon that method of study.

One other point should be mentioned before we leave this topic. Those who use cramming properly, that is, as a supplementary method, may fail to reap much benefit from it. Very often this is owing to the fact that they place too much emphasis upon memorizing details and not enough upon being sure that they have their subject well organized. If the main emphasis is placed upon getting the subject well organized, the memorizing of important details will often take care of itself. Then again, the crammer may try to do too much during the concentrated study period. He may set out to learn every fact he has heard of in the field with which he is concerned, and he may treat all these facts as equally important. This is likely so to divide his energy that he does not learn anything really well. The solution for this difficulty lies in the direction of emphasizing the organization of the facts before one. When the main lines of organization are clear, one can see the relative importance of each fact and distribute his available time accordingly.

Can memory be trained? — One's ability to memorize some particular type of material can be trained to a striking degree. The more one learns about chemistry or politics, the more easily are new facts in these fields acquired. This, as we said once before, is because anything pertaining

to a familiar subject is more meaningful to us — it fits more naturally into the knowledge already possessed. Said Professor James: "Let a man early in life set himself the task of verifying such a theory as that of evolution, and the facts will soon cluster and cling to him like grapes to their stem. Their relations to the theory will hold them fast; and, the more of these the mind is able to discern, the greater the erudition will become. Meanwhile the theorist may have little, if any, desultory memory. Unutilizable facts may be unnoted by him, and forgotten as soon as heard. An ignorance almost as encyclopedic as his erudition may coexist with the latter, and hide, as it were, within the interstices of its web."[1] We may conclude that the best method of training the memory for the facts of chemistry, politics, banking, or art is that of setting to work and acquiring some knowledge about the subject.

It is possible to train a person in the general technique of memorizing so that he will be better able to remember material of whatever kind. The results of this general type of memory training may even be quite marked, though they will scarcely ever equal the results of the more special training which consists in learning facts of the same sort as one will later want to memorize easily. The training of one's general capacity to remember consists in learning to put into practice just such rules as we have been discussing in the present chapter. It consists (1) in learning to pick out what is really worth memorizing; (2) in getting a perspective or bird's-eye view of the material; (3) in consciously looking for relations between the new matter and established knowledge and interests; (4) in falling back upon rote memorizing where that is appropriate; (5) in keeping one's mind upon

[1]*Talks to Teachers on Psychology; and to Students on Some of Life's Ideals*, pp. 125–126 (Henry Holt and Company).

the fact that he is trying to memorize what is before him; (6) in attempting to recall frequently what is being learned; (7) in discovering for each type of material the optimal length of study period; and (8) in making wise use of the method of cramming or intensive reviewing.

There often appear in the newspapers and magazines advertisements of schemes for memory training. To the extent to which these make use of such principles as we have been discussing they are sound enough, though one does not need a special course of study to master these simple principles. But very often the systems of memory training which are put upon the market make use of certain tricks of memorizing, sometimes called *mnemonic* devices. Most of us have heard of tricks of this general type. Perhaps I meet a man by the name of Brooks. He is in the steamship business. Now I say to myself: "Steamships run in water. Water runs in brooks. The next time I see this man I must think of a stream of water and then I shall remember that his name is Brooks." Methods of this kind may be an aid to memorizing at times, but there are at least two facts which indicate that they are not to be taken too seriously. In the first place, if one gives as much attention as is demanded for using any such method, he will probably remember what he wants to, whether he uses the method or not. In the second place, if mnemonic devices are generally employed, they must be elaborate enough to provide for everything one wants to remember. In that event the remembering of the system becomes, itself, a formidable task.

B. Forgetting

Why we forget. — We forget for the same reasons that we lose other habits than those of memory. In our chapter

on the fixation of habits we said that a habit may lose its power of functioning because we are not in surroundings that contain the peculiar stimulus or combination of stimuli necessary to set the habit into action. The two examples given there were, as a matter of fact, both habits of the memory type. One, you will remember, was the case of the missionary who could not recall the Chinese language well except in China. The other was the case where the name of a well-known schoolmate could not be recalled in a new environment. We also said, in that earlier chapter, that a habit may lose its power of functioning because some subsequently formed habit has interfered with it. The instance was cited where a new method of shifting gears on an automobile interfered with the ability to shift gears according to a method formerly learned. Similar instances can frequently be observed in the retention of ideas. If, between the learning and recall of a list of numbers or nonsense syllables, a second list of numbers or nonsense syllables be learned, one's capacity to recall the first list will be seriously interfered with. This is called *retroactive inhibition*. As for habit in general, it is true for memory that the susceptibility to this type of interference depends upon the similarity between the interfering memory and the memory that is broken up. The more similar the two are, the more likely, within certain limits, there is to be this interference. It is also true that the better learned a material is, the less susceptible it is to interference.

Forgetting is slower for meaningful material. — Material which is relatively full of meaning is not only memorized easily. It is also forgotten slowly. Experiments have been performed to discover the rate at which memorized material is forgotten. Their results show that meaningful material, like poetry, is retained somewhat better than

meaningless material, like nonsense syllables, even where the two kinds of material have been learned with equal thoroughness. The data in the following table[1] are taken from an experiment in which the amounts of poetry and nonsense syllables retained after varying lengths of time were compared.

Intervals since original learning	*Percentage of retention in nonsense syllables*	*Percentage of retention in poetry*
5 minutes	98	100
20 minutes	89	96
1 hour	71	78
24 hours	68	79
2 days	61	67
6 days	49	42
14 days	41	30
30 days	20	24

In all but two of the time intervals considered in this table, poetry is better retained than nonsense syllables.

Forgetting goes on most rapidly shortly after learning. — If the columns of figures in the table be examined once again, it will be seen that forgetting is much more rapid soon after learning than it is later. In the case of the nonsense syllables, 30 per cent (98–68) is forgotten between 5 minutes and 24 hours after learning, and during the 5 days following only 19 per cent (68–49) is forgotten. In the case of the poetry, 58 per cent (100–42) is forgotten during the first 6 days, while during the next 24 days only 18 per cent (42–24) is forgotten. This rapid initial forgetting is not so marked if material is very thoroughly mastered.

The power to recall is lost faster than the power to recognize. — When we are unable to recall a name we often remark that we should be able to recognize that name at once if we heard or saw it. This ability to recognize objects

[1]Adapted from Ladd and Woodworth, after (Radosauljevich).

after the power to recall them has been lost is brought out clearly by a number of experiments. The results of one such experiment are shown in the next table.[1] A comparison is here made between the number of nonsense syllables that could be reproduced in writing and the number that could be recognized at various intervals after learning.

Intervals since original learning	*Retention according to written reproduction (%)*	*Retention according to recognition (%)*
20 minutes	88.1	97.8
1 hour	82.1	94.6
4 hours	60.5	93.3
1 day	39.2	74.6
2 days	26.7	71.5

Recall is typically full of errors. — As forgetting proceeds, we become less and less able to recall facts we formerly knew. This is especially true if, at the time of observing certain events, we do not know that we shall later have reason to remember them. But even though a great amount of forgetting has gone on since our observation of some scene, we may still describe it in considerable detail. Where actual facts are forgotten, there is a tendency for imaginary facts to replace them without our being aware that some of the elements of the memory are true and others false. This is well illustrated by the conflicting testimony often given by honest witnesses.

Professor Münsterberg told of the testimony of two respectable and disinterested gentlemen in connection with an automobile accident.[2] One declared that the road was dry and dusty; the other was sure that it had rained and that the road was muddy. One said that the automobile was running slowly; the other, that it was rushing along at a high rate of

[1]Adapted from Luh, *Psychological Monographs*, 1922, Vol. 31, p. 21.
[2]*On the Witness Stand*, 1923 impression, p. 15.

speed. One swore that there were very few people on the village road; the other, that a large number of men, women, and children were passing by. Many other examples of this type of disagreement could be cited. Several years ago in Lincoln, Nebraska, a woman was hurt in alighting from a trolley car. Of those who plainly saw the accident some testified that the car started before the victim had got off. Others were quite certain that the car did not move until several seconds after she had fallen to the street. Police officers have little confidence in the description of a culprit which any single witness to a crime is able to give them. One summer afternoon a number of people were seated on the lawn before their house. Two men passed along the walk in front of them and turned at the first corner. Shortly afterward there was the sound of a revolver shot, and within a moment or two the same men came back around the corner on the run and again passed plainly in view of the people on the lawn. Later these people learned that a robbery had been committed, and they were asked to describe the men whom they had seen going to and coming from the scene of the crime. One witness said that both were of the same size, that both had on blue suits and straw hats. Another said that they were of the same size, but that one was dressed in gray and the other in blue, and that one wore a felt hat. A third witness agreed with the second in saying that the hats and suits differed, but this witness insisted that one man was very much shorter than his companion.

A number of interesting experiments have been conducted under such conditions that the actual facts were known and the testimony given by different witnesses could be compared with the facts. The following instance occurred at a meeting of psychologists held at Göttingen.

Not far from the hall in which the Congress was sitting there was a public fête with a masked ball. Suddenly the door of the hall was thrown open and a clown rushed in madly pursued by a negro, revolver in hand. They stopped in the middle of the room fighting; the clown fell, the negro leapt upon him, fired, and then both rushed out of the hall. The whole incident lasted hardly twenty seconds. The president asked those present to write a report immediately, since there was sure to be a judicial inquiry. Forty reports were sent in. Only one had less than 20% of mistakes in regard to the principal facts; fourteen had 20% to 40% of mistakes; twelve from 40% to 50%; thirteen more than 50%. Moreover, in twenty-four accounts, 10% of the details were pure inventions, and this proportion was exceeded in ten accounts and diminished in six. Briefly, a quarter of the accounts were false.

It goes without saying that the whole scene had been arranged and even photographed in advance. The ten false reports may then be relegated to the category of tales and legends; twenty-four accounts are half legendary, and six have a value approximating to exact evidence.[1]

The filling in of the gaps of memory with fictitious facts may seem upon first glance to be a matter of pure chance. There are, however, certain definite principles according to which this filling in takes place.

1. The fictitious facts are almost always consistent with the facts actually remembered. In an experiment similar to the Göttingen one, an individual, by prearrangement, walked into a lecture room full of students, snatched up the lecturer's watch which lay upon the table, and dashed out through the door. Some of the students, in describing the affair, before being apprised that it was merely an experiment, said that the thief wore rough clothes, was unshaven, and staggered in plain intoxication. As a matter of fact, he was neatly

[1] Quoted by Gault, *Social Psychology*, p. 133, from von Gennep, *La Formation des legendes*.

dressed, smooth shaven, and sober. But note that the items, as filled in, were perfectly consistent with the man's actions.

2. In recalling an object or event in order to answer a question about it, the way in which gaps of memory are filled in frequently depends upon the specific way in which the question is asked. If, for example, the witnesses of the Göttingen incident had been asked how much taller the clown was than the Negro, many of them would surely have imagined the clown to have been taller, whether he was or not. If we wish accurate information from those whom we are questioning, it is necessary carefully to avoid such leading questions.

3. Even if one has no intention of deceiving, he is inclined to fill in the gaps of memory in accordance with his desires and prejudices. If one is testifying on behalf of a friend, forgotten details of his friend's conduct are likely to be imagined in such a manner as to favor the friend's case. A person who has been through a great fire or some other dangerous situation will, in telling of his experience, add harrowing details which were not present in that experience. In such cases there is probably no attempt to deceive. The story teller is simply under the dramatic sway of his own story. He notes the effect it is having upon his auditors and he fills out unremembered details in such a manner that they will enhance the artistic value of the story which he is striving to make successful.

False recognition. — False recognition is something that all of us experience from time to time, and most of us have wondered about it. The following case is typical.

Somewhat more than a year ago, I visited the city prison of Mazatlan, in Mexico. It consisted of a court open to the sky, on three sides of which the cells opened, the fourth being a high wall. The entrance was by an arched passage-way,

with three barred gates. The court paved with cobbles, the entrance, the several rooms, every surrounding internally, seemed as familiar to me as home. Not so with any portion of the exterior. Yet I had never been within three thousand miles of the place until this journey.[1]

All sorts of queer explanations have been given for these false recognitions. Some have held that we must have had the falsely recognized experiences in dreams or in some previous state of existence. Still, the real wonder is not that we occasionally commit errors of recognition, but that we do not commit more of them than we do. The chances are that the plan of the prison in the illustration above was very much like that of some other building or picture of a building which had once been seen but now was practically forgotten. If the other building had been well remembered, the sight of the Mexican prison would simply have brought it to mind. There would have been no confusion between what had previously been seen and what was now being seen. But, since the first building was largely forgotten, it was possible to feel that the Mexican prison was identical with a vague something or other of previous experience.

Summary of the Chapter

1. Memories are ideas which represent the past essentially as it was experienced by him who is remembering.

2. The ideas of memory may have their origin in actual events, or they may first come to us as ideas.

3. One can remember, or try to remember, too much as well as too little. A good memory requires that one select wisely that which is most worth remembering.

[1] Quoted by Burnham, *American Journal of Psychology*, 1888–89, II, 440, from Osborne, "Illusions of Memory," *North American Review*, May, 1884, pp. 476 ff.

4. When studying with the purpose of remembering, it is well to get a view of the subject as a whole. This makes possible a better selection of what is most worth remembering. It also makes possible an appreciation of the relationships existing between different parts of the subject-matter.

5. The ease with which we are able to memorize any material depends upon what we already know. In many cases, previously acquired knowledge will aid us in learning something new. Sometimes, however, previous knowledge will interfere with the formation of new memories.

6. That which is in line with interests which we already have is also memorized with relative ease. This is partly owing to the fact that we usually know a good deal about those things in which we are interested.

7. Memorizing which depends largely upon sheer repetition is called *rote memorizing*. That which takes advantage of the logical relations of new material to that which is already known is called *logical memorizing*. The latter is so much easier a process that, once we are used to it, we are likely to avoid rote memorizing. But no one ever reaches a point where he can afford to neglect rote memorizing altogether.

8. Casual experiences have a much better chance of being remembered if there is a conscious intention to memorize them. It is just as well that memory depends so much upon intention to remember; otherwise our minds would be cluttered with useless information.

9. For the most efficient memorizing it is not enough that we merely read over our material. Much will be gained if we make occasional attempts to recall. This will insure our giving the material completer attention. It will also reveal to us those points where our knowledge is weakest.

10. Periods of study should not be so long as to lead to boredom or fatigue. On the other hand, they should be long enough to enable us to cover some natural unit of material, such as an article, a chapter, or a section of a book. The study periods should occur frequently, so as to avoid forgetting.

11. Where, as in a school course, we have a large amount of material to master, it is wise to indulge in a final, intensive review as well as in a rapid preliminary survey. This so-called cramming at the end of a course is obviously bad practice if it be relied upon as the main method of acquiring knowledge.

12. There are two important means of training memory. One consists in accumulating sufficient information to make more meaningful such new facts as one wishes to memorize. The other consists in the adoption of wise methods of study. Most mnemonic devices are of very limited usefulness.

13. There are two main reasons why we forget. In the first place, we may get out of touch with anything capable of reminding us of a given memory. In the second place, we may acquire new facts which tend to interfere with and break up something previously learned.

14. The more meaningful any material is, the less rapidly it is forgotten.

15. The most rapid forgetting usually takes place immediately after memorizing.

16. The power to recall what has been learned is lost more quickly than the power to recognize the same material.

17. Forgetting does not lead to mere inability to describe the forgotten facts. There is a tendency for us to replace the forgotten facts with imaginary ones without realizing that we are doing so. This is well illustrated in the testimony of witnesses. The imaginary facts are determined

by what we really do remember, by what questions are asked us, and by what we desire in regard to these facts.

18. The process of forgetting sometimes leads us to recognize that which we have never before experienced. This is probably because we have experienced something like the happening in question, but have so nearly forgotten it that we are unable to tell the difference between the partially remembered happening and that which is falsely recognized.

PROBLEMS

1. What are the advantages in being able to acquire ideas of history indirectly, without going through the actual experiences which those ideas represent? What do you believe to be the limitations of this method of acquiring ideas?

2. Consider in detail your experiences during the past twenty-four hours. What proportion of them do you hope to remember fairly permanently?

3. When an orator or actor forgets his lines and has to be prompted, the difficulty seldom occurs in the middle of a line or paragraph. It is usually at some natural termination, such as the end of a line or paragraph, that memory fails. Can you see any relationship between this and the fact that probably the majority of us do our memorizing by mastering one relatively small part of our material at a time?

4. Give an instance in which your previous knowledge has made it easier for you to acquire certain new facts. Give an instance in which previous knowledge has made it particularly difficult for you to learn new facts.

5. Make a list of the subjects you have studied in school. Rank them according to the amount of interest that you have in each. Rank them also according to the grades you have achieved in them. How do these two rankings compare?

6. Study the following list of words until you can repeat it without an error. Record the time required for this task.

cat	lie	mix
red	far	tar
sky	see	lip
too	win	sit

Now memorize the following list of nonsense syllables and record the time required.

rup	maz	pif
zev	vuy	cax
sug	zam	gah
daf	cak	wov

Which task is accomplished more quickly? Why?

7. A teacher once asked the members of her class how many steps there were leading up to the entrance to a library building which all of them passed on their way to school. None of the students knew. Why would it be unwise to assume that the students' memories were poor?

8. Are tests good for anything besides finding out how much students have already learned? Why?

9. Why is it impossible to state the exact manner in which study time can best be distributed?

10. In some schools and colleges no tests at all are given until the very end of the course, when there is a single examination from which the student's accomplishment is judged. What are the advantages of such a system? What are the disadvantages?

11. If you had great difficulty in remembering the dates of historical events, how would you proceed to improve your ability in this regard?

12. Under which condition would you be more likely to remember the name of an old acquaintance: if you met him on a street where you had often seen him before, or if you met him on a street where you had never seen him before? Why?

13. If you are introduced to a number of strangers, one after the other, why is it so difficult to remember their names?

14. What reasons can you give why very meaningful material is forgotten so slowly?

15. If forgetting is most rapid just after learning, when is the best time for reviewing?

16. Why do so many people say that they can remember faces better than names?

17. If, in the testimony of a number of witnesses, there were points on which there was complete agreement and others on which there was considerable disagreement, which would most likely be true? Why?

18. If two witnesses both reported an event down to its minutest details and if their reports were in perfect agreement, what would you think about their honesty? Why?

19. Why do the faces of members of another race look so much more alike to us than faces of members of our own race?

REFERENCES FOR FURTHER STUDY

Whipple, *Psychological Bulletin*, 1918, pp. 233–247; or *Readings in General Psychology*, Ch. XIII, Selection 5, p. 318 ff.

James, *Talks to Teachers on Psychology*, etc., pp. 124–129; or *Readings*, Ch. XIII, Selection 6, p. 328 ff.

Judd, *Psychology of High-school Subjects*, pp. 70–72; or *Readings*, Ch. XIII, Selection 7-B, p. 336 f.

CHAPTER XI

IMAGINATION

A. Characteristics of Imagination
B. The Sources of Original Thought
C. Imagination and Reality

Questions to Keep in Mind while Reading this Chapter

1. How do we develop original ideas?
2. What part does imagination play in real living?

A. Characteristics of Imagination

Imagination carries us beyond personal experience. — Thought, in so far as it represents objects and events which are beyond our personal experience, is imagination. These imagined objects and events may be placed in the past or in the future. It is an act of imagination if I think of my boyhood as it would have been had I been reared on a farm instead of in town. It is an act of imagination if I think of a dinner which I am to attend next week. Imagined objects and events may also be placed in the present. When a child climbs to the top of a shed and imagines he is a structural steel worker busy upon a new skyscraper, he is not imagining something about the past or the future. He is imagining about the present moment.

But in any case, ideation is imaginative only to the extent to which it sets up a world which has never actually been experienced by the imaginer. While no train of thought ever breaks away completely from the actual world, thinking

is imagination only to the extent to which it does represent the unreal. In the anticipation of a sea voyage to be taken several months hence, some elements of my ideation are imaginative and others are not. I have seen ocean liners, and if my present thought represents some ship actually seen, it is an act of memory rather than an act of imagination. But the thought of standing on the deck of a liner next September does introduce some elements that have not yet, at least, any counterparts in the world of actuality. When I consider how excited I should be if suddenly notified that I were the possessor of a million dollars, my ideation is to some extent imaginative and to some extent memorial. I have experienced the excitement of sudden good fortune, so that to think of such excitement is not necessarily an act of imagination. Still, it has never been my lot to come into possession of a million dollars, and to think of such a thing as occurring is to engage in an act of imagination.

No sharp line exists between imagination and memory.— All thinking involves ideas representative of what the thinker has known directly in his own private experience. All thinking also involves ideas representative of objects and events outside of the personal experiences of the thinker. The question thus arises as to when, strictly speaking, a person may properly be said to be remembering and when imagining. Perhaps the most important point to keep in mind in this connection is that there is no sharp line between the two. We saw in the last chapter that imagination creeps into the recall of even fairly recent experiences and adds to that recall certain elements of unreality. In our reference to my imagining myself on shipboard, we saw that the thought of the ship, if it be clearly based upon some ship I have actually seen, is a memory element in a largely imaginative train of thought.

The only basis, then, for our calling one train of thought imaginative and another memorial, is that in the former the central or preponderant reference of the thinking is to that which lies beyond the thinker's personal experience, while in the latter the reference is to that which actually has been experienced. Thinking of standing upon the deck of a ship next September is imagining. Thinking of standing upon the deck of a ship in the summer of 1912, as I really did, is remembering. Although the thoughts of the future voyage contain elements, such as the idea of the appearance of the ship, which date back to definite past experiences, the main reference of my thinking is to a world of events up to this time outside of my personal experience. Although the thoughts of the trip of 1912 undoubtedly refer to features of that event which actually were as nonexistent as many of the elements in the testimony of the witnesses discussed in Chapter X, the main reference is to events that did take place, and what is thought about them is preponderantly true.

All imagination depends upon personal experience. — If I imagine an eight-legged dog, or a bright green horse standing on its head, it might seem that those acts of imagination were solely independent of actual experiences. As a matter of fact, every element in those acts is dependent upon past experiences. In the case of certain elements, the fact that they date back to real experiences is evident. For example, the head of the imagined eight-legged dog is simply a recall of the appearance of the head of a certain bull-dog. The horse, too, in many of its aspects, is like horses seen before.

We must admit that I have never seen an eight-legged dog, nor a bright green horse standing on its head. Still, I have seen legs of dogs, as well as the color, bright green, and I have seen men, if not horses, standing on their heads. Even

the strangest elements, then, of my imaginings are based upon my own experiences. If one had never seen any color like green, he could not imagine a green horse.

How, then, are we going to escape the apparent contradiction between the statement that imagination carries us beyond the bounds of our personal experience, and the conclusion, just reached, that every element in our imaginings depends upon such experience? The solution for this problem lies in a point made in our discussion of ideas. There it was said that "the ideas which the author puts into his novel and the ordinary man into his day-dreams are based upon earlier personal experiences, but the present combinations into which they are put are distinctly new." So is it with imagination of every sort. Dogs and legs of dogs are not new. But to endow one dog with eight legs gives a result that is somewhat original. At least it is a something which we have never actually experienced. Horses are not new, bright green is not new, and standing on one's head is not new, but to endow a horse with a green coat and stand him on his head gives what all of us should agree is largely a matter of imagination.

Since imagination depends upon our personal experiences, it is a type of habitual activity. This does not mean that acts of imagination are necessarily fixed and stereotyped, but merely that the elementary activities which make up our imaginings are activities which have been acquired by experience. Habits of imagination may, of course, become quite as fixed and regular as do thoroughly fixated habits of movement. There are men who set up day-dreams in which they see themselves attaining fame through some great achievement in politics, letters, business, or athletics. Once a highly gratifying day-dream of this kind has been constructed, it may be engaged in with little modification time

after time for a long period. On the other hand, although every element of an act of imagination may be a habit, the larger act may be a more highly variable affair. In fact, it is the essence of imagination that old ways of thinking are or may be combined into new ways of thinking. From the standpoint of a study of imagination, we are not nearly so much interested in the fact that a certain day-dream is repeated time and again as we are in the fact that the day-dream was constructed in the first place.

New combinations of ideas are essential for progress. — The typist acquires her skill by combining in new ways habits of reading, spelling, and moving hands and fingers. The bookkeeper learns to put old habits of computation to new uses. The child combines random movements of legs and arms into nicely balanced walking. And the highest achievements of intelligence depend upon the development of new combinations of *ideas* already possessed, that is, upon imagination. It is never enough to think only in terms of the past and present. The future must be taken into account too. This, if it is to be done accurately, demands a rearrangement of ideas. The future is never just like the past or present, wherefore adequate thinking about it requires imagination.

As we shall see more fully in the next chapter, reasoning contains imagination as an essential feature. When an animal, let us say a dog, has a problem to solve he actually tries out a large number of solutions. If, while hungry, he is put into a cage, just outside the door of which is a tempting piece of meat, he will try all sorts of methods of escape. He will bite and pull at the bars, bark, whine, and run this way and that. Finally he may strike his nose against the latch in such a way as to spring it and let the door fly open. Such a *trial and error* procedure is contrasted with reasoning. The distinguishing fact about the latter is that the correct

solution is often hit upon without first putting a large number of possible solutions into movement to discover whether they will work. Instead of being actually tried out, they are tried out in imagination. The reasoner constructs in thought the probable outcome of the application of this solution or of that. If his imagination shows that outcome to be a satisfactory solution of the problem, then thought can be transformed into movement.

B. The Sources of Original Thought

Problems give rise to new ways of thinking. — Reasoning is an attempt to construct in thought the solution of some problem. The goal we wish to attain is in this case recognized, and the part played by imagination consists largely in foreseeing how well some mode of action, which is merely thought of, will further the attainment of that goal. This is, above all, a business-like procedure.

There are other conditions under which the presence of a problem gives rise to imagination, even where there is no hope of finding a mode of action or thought which will furnish a genuine solution. All of us engage in day-dreaming, and it is a striking fact that these day-dreams are the results of problems that we face. These problems are, as a rule, the outcome of unfulfilled longings. The boy who desires athletic distinction, but who can never hope to realize that form of glory because of insurmountable physical limitations, will construct day-dreams in which athletic achievements are attained. He does not necessarily entertain these ideas as possible ways out of his difficulty, as possible methods of attaining the longed-for goal. They are rather enjoyed for their own sake. The ideas are not, as in reasoning, plans for action or for further thinking, but they are substitutes for the genuine.

New ways of thinking may be imparted to us by others. — New and skillful combinations of movement may be set up as the result of a laborious struggle with some problem. But often the construction of the new combination is made prompt and easy by virtue of the instruction or guidance which we receive from others. Instruction or guidance may similarly facilitate the formation of new ways of *thinking*.

The anticipation of a journey into countries never visited before consists in imagining many things about the places to be visited, methods of travel, and the like. Now there is very little basis in my own personal experience for imaginings valid enough to guide my preparation for the journey. But I can talk to others who have made this journey, I can read books about traveling in foreign lands, and out of the ideas which are thus imparted I can construct fairly adequate notions of what lies before me. Because of what two friends have said, I anticipate very cold weather at sea, and, acting upon that idea, I shall take with me a heavy coat. Because of what another friend has told me, I think of the Atlantic next December as stormy and rough. Acting upon that idea, I shall try to book my return passage on as large and as steady a ship as possible. Somewhere in a book I have read that the heavy snows render certain Alpine places inaccessible by the middle of October. Knowing when I shall be in Switzerland, I can even now imagine something of the things I shall see and something of the things I shall be unable to see while there. Thus is my imagination made more accurate and useful by the guidance I am able to get from others.

The less practical imaginings in which one engages — the imaginings of the day-dream type — may also receive the benefit of considerable guidance. The clerk who lives a humdrum life may indulge in plays, motion pictures, and

printed stories. These set up in him the most elaborate imaginings with scarcely any effort on his part.

The plays we see and the stories we read do more than simply furnish ready-made day-dreams. They furnish us with materials out of which new day-dreams can be fabricated. Perhaps the bored clerk imagines himself a prospector for gold in a rough section of Alaska. Perhaps he is attacked by three ruffians whom he bests single-handed. Perhaps he finally strikes it rich and returns to civilization to live out his remaining days amid the luxuries his gold can buy. Here is a revision and reconstruction of a motion-picture story made in the interests of the peculiar needs of a particular individual.

The work of fiction has still another frequent result. It creates unfulfillable desires which become the motives of our day-dreams. The clerk might possibly have been just as bored with his present occupation and quiet mode of living if he had never seen a motion picture and never read a frontier story. But having indulged in these dissipations, he began to see definite, if actually unattainable, alternative ways of living. In other words, the very desire for a life of brave adventure, for which his day-dreaming is a substitute, arose out of ready-made day-dreams furnished by play and story.

Originality is aided by broad experience. — It is sometimes assumed that originality of imagination has little or nothing to do with the extent of one's knowledge. Occasionally it does happen that a notion of considerable originality is produced by a person of relatively slight experience. The college wit contributes jokes as bright and original as those of the experienced, professional humorist. The young poet sometimes writes a short poem of unquestioned brilliance. William Cullen Bryant was only eighteen years of age when he wrote "Thanatopsis." The inventor of a clever and

useful machine may be hopelessly ignorant of the science of mechanical engineering. Nevertheless, the man of sustained and consistent originality must have had wide experience. Milton and Shakespeare had great stores of information upon which to draw, and Newton is said to have had at his immediate command practically all of the scientific knowledge of his time.

It is not difficult to see why there is such a close relationship between originality and knowledge. Imagination consists in setting ideas into new combinations. The first requirement for such a process is the possession of the ideas. One cannot utilize in imagination ideas that he does not possess. A person of very limited experience may, as we have seen, make use of his few ideas in a brilliantly original manner, but his imagination is definitely limited by the scarcity of information at his command. Where experience is limited, original thought is likely to be original only to the thinker himself. A new employee in a shop or factory has been known to make an original suggestion worth thousands of dollars to his employers. Such fortunate occurrences stand out as exceptions, however, and the author of such a suggestion is not likely to continue to originate profitable schemes applicable to a business unless he straightway begins adding to his store of ideas about that business.

Original combinations of ideas are aided by unusual combinations of experience. — The newcomer in a business house ordinarily does not have revolutionary ideas about the conduct of affairs, and when he does, they are likely to be impracticable. Still, the newcomer does advance a valid and novel scheme once in a while, and there is some reason to believe that this event is not always pure accident. His previous experience may have been of a sort uncommon for a

man in that particular business, and the ideas to which it gave rise may be just the ones to combine advantageously even with the first ideas he acquires about that business.

A thorough mastery of two or more different and yet associated bodies of knowledge is as good a basis as can be obtained for original thinking. Such thinking is especially likely to be done by a banker who has a knowledge of farming or of building trades, by a physiologist well grounded in physics, by a novelist who is acquainted with the ways of living in some other place or historical era, by the specialist in mental diseases who also knows much about normal mental processes.

Original thinking may become a habit. — There are individuals who make a habit of mulling over their ideas, and getting them into new relations and combinations. In such individuals original thinking becomes as natural and as easy as original thinking ever is. When they read a book, they do not stop there. They recall from time to time ideas that they have gathered from it. They compare in a reflective manner the opinions of one author with those of another. All this tends toward the production of new ideational combinations. Ideas obtained from first-hand experience as well as those obtained from books are treated in this way.

The creative thinker does not accept things at their face value. — Perhaps the most striking characteristic of the creative thinker is his unwillingness to accept the world of facts or ideas at its face value. He looks behind the facts for meanings, relationships, and possibilities which have hitherto escaped notice. He is not content to accept ideas just as they are imparted to him. He must evaluate them anew. He must determine just how well, after all, they do correspond to the world of facts. Or, if those ideas be of a fanciful sort, he must redetermine their artistic value.

Where changes seem to him desirable, he makes them. Such a thinker dares entertain the notion of sailing west to India instead of east. Such a thinker looks for a relationship between lightning and electricity.

Professor Calkins shows the contrast between original and less original thought by setting side by side two well-known poems, Shelley's "Sensitive Plant" and Cowper's "Winter Garden."

Who loves a garden, [is Cowper's prosaic beginning]
. . . loves a greenhouse too.
Unconscious of a less propitious clime,
There blooms exotic beauty, warm and snug,
While the winds whistle and the snows descend.
The spiry myrtle with unwith'ring leaf
Shines there and flourishes. The golden boast
Of Portugal and western India there,
The ruddier orange, and the paler lime,
Peep through their polish'd foliage at the storm,
And seem to smile at what they need not fear.
Th' amomum there with intermingling flow'rs
And cherries hangs her twigs. Geranium boasts
Her crimson honors, and the spangled beau,
Ficoides, glitters bright the winter long.
All plants of ev'ry leaf, that can endure
The winter's frown, if screen'd from his shrewd bite,
Live there, and prosper. Those Ausonia claims,
Levantine regions these; th' Azores send
Their jessamine, her jessamine remote
Caffraria, . . .

No one [Professor Calkins goes on to say] can read this list of flowers without the conviction that Cowper is either 'reproducing' the rows of plants as he saw them one after another in a greenhouse, or else that he is framing an image after the most mechanical fashion. There is certainly little that is individual in the entire description, and the images, regarded from the standpoint of association, are connected as undifferentiated totals, instead of being broken up into more remotely suggestive elements.

Shelley also enumerates the flowers of his garden, but in a very different manner.

> The snowdrop, and then the violet,
> Arose from the ground with warm rain wet,
> And their breath was mixed with fresh odor, sent
> From the turf, like the voice and the instrument.
>
> Then the pied wind-flowers and the tulip tall,
> And narcissi, the fairest among them all,
> Who gaze on their eyes in the stream's recess,
> Till they die of their own dear loveliness;
>
> And the Naiad-like lily of the vale,
> Whom youth makes so fair and passion so pale,
> That the light of its tremulous bells is seen
> Through their pavilions of tender green.

We have here [says Professor Calkins, commenting upon this poem of Shelley's] neither a reproduction nor a mechanical composition, but an organically related, individual experience. Almost every one of these exquisite images is connected in partial association with that which has preceded it: the mingling of earth-fragrance with the odors of the flowers suggests the interpenetration of voice and instrument; the early fading of the narcissi, mirrored in the stream, rouses the fancy that they 'die of their own dear loveliness'; the tall lily leaves suggest sheltering pavilions. And, side by side with Cowper's superficial and fanciful comparison of Ficoides with the spangled beau, Shelley's images of music, of beauty, and of passion fairly throb with life and meaning.[1]

Creative thought is relatively rare. — The easy road is that of accepting things as they are or as people say they are. Even when one has need of a day-dream to satisfy in part some unfulfilled desire, it is easier to utilize a conventional day-dream which one has read in a book than to construct a story suited to one's own special needs. One may

[1] *An Introduction to Psychology*, pp. 206, 207 (The Macmillan Company).

start off in business, in science, or in art full of the intellectual energy that gives rise to novelty, but, unless one be on his guard, he is likely to rely more and more upon ideas as he or others have worked them out in the past. Too much sameness of scene or occupation is a prevalent cause for the destruction of originality in those who once challenged almost every fact and idea confronting them. We have remarked that unusual combinations of experiences are pre-eminently the stimulators of thought that is original. And it is also true that there is no surer way to fall into stereotyped and conventional modes of thought than by avoiding novel experiences. A certain amount of travel, of intercourse with new acquaintances, of reading on new subjects, and, above all, of reflection upon these added experiences will keep one out of a narrow intellectual rut.

Upon whatever we turn our attention, there are customary ways of thinking about that subject. So strong are some of these customary ways of thinking, and so backed are they by the prestige of their very antiquity, that only the exceptional and hardy intellect can persist in an original opinion, even if its truth should, so far as the logic of the matter is concerned, be obvious to all. The evidence was greatly in favor of a spherical earth long before men would entertain the idea seriously. They had thought the world was flat for centuries, and that inaccurate conception kept a better one from even entering their minds. A poem of Sam Foss's which Professor Ross has quoted[1] is a happy illustration of our point.

THE CALF PATH

One day, through a primeval wood,
A calf walked home as good calves should,
And left a trail all bent askew,
A crooked trail, as all calves do.

[1] *Social Psychology*, p. 257 (The Macmillan Company).

Since then two hundred years have fled,
And I infer the calf is dead,
But still he left behind his trail,
And thereby hangs my moral tale.

The trail was taken up next day
By a lone dog that passed that way;
And then a wise bell-wether sheep
Pursued the trail o'er dale and steep,
And led his flock behind him, too,
As good bell-wethers always do.

And from that day, o'er hill and glade,
Through those old woods a path was made,
And many men wound in and out,
And bent and turned and crooked about,
And uttered words of righteous wrath,
Because 'twas such a crooked path.

But still they followed — do not laugh —
The first migrations of that calf,
And through this winding woodway stalked
Because he wobbled when he walked.

. . . .

And men in two centuries and a half
Trod in the footsteps of that calf,
For men are prone to go it blind,
Along the calf-ways of the mind,
And work away from sun to sun,
To do as other men have done.

Originality does not guarantee the truth or value of thought. — The incoherent nonsense of an insane patient may be original enough, yet the fact of originality does not, in itself, insure the truth or value of his thinking. Consider the thought processes of the author of the following speech:

Well, Doctor, I tell you I suffered terribly this winter, also on post of duty. I do not know anything about it; there is an illustration there. I cannot blame the band while at school about their music. That thermometer there

is to tell whether you live or die, and it becomes such a dangerous position that the enemies approaching at this post of duty, I cannot do it with the light. That man escaped. He is living at his house in Birmington, N. Y., where I know not. I know that his name is Irish. They will not take him to his rightful home in the condition of such by which he has no means of support by attending bar. I was kidnapped upon the ocean, and taking en route to this place I know not. Well, as I was going to tell you, I am the enemy himself. These people here cannot perform an operation. They do not know what they are. Well do you know me! I am the king of Ireland and also of all countries in existence. I was the fellow that killed the queen. I do not know who she was. I got the picture of him. His last name was Duff. I cannot get into communication with him.[1]

Such combinations of ideas are original enough. They certainly do not represent ideas or objects or events as they have occurred upon some former occasion. The results of past experiences must have combined and produced this novel and original flow of thought. But with all its originality, such thinking does not uncover hidden truth nor does it rise to new artistic heights. It corresponds neither with a world of actual fact nor with one of legitimate fancy.

Originality, in other words, cannot be evaluated in and for itself. Originality is meritorious only when it furthers the worthy enterprises of life. In this regard it is only like other facts of mental life. If memory were evaluated in and for itself, who could display a better memory than Miss Bates? She did not seem to forget *anything!* There was recently described in one of the psychological journals a feeble-minded boy who had a remarkable memory. Give him a date, such as March 8, 1908, and he can immediately give you the day of the week on which that date occurred.

[1] Quoted by White, in *Outlines of Psychiatry*, p. 146.

Within a range of something like twenty years his memory for days and dates is almost perfect. And yet no one would seriously praise the memory of either Miss Bates or the feeble-minded boy. Their memories are complete enough and accurate enough, but they are not particularly useful for the more important purposes of life. Some people have held to the superstition that habits, as such, are undesirable, and that one should keep as free from them as possible. But we know now that habits cannot be evaluated simply as habits. Their consequences must be taken into account. The habit of overeating is bad, not because it is a habit, but because of its results. The habit of being friendly or cheerful is good, not because it is a habit, but because of its results. So it is with originality. A cleverly planned crime may be original, but it is not its originality which makes it bad. It is bad because it is a crime. A story may be very original, but unless it fits in with certain artistic needs and standards, it will not be judged good.

When old ways of thinking become inadequate, imagination offers new ways of thinking, some of which may fill one's needs and some of which may be useless. Without imagination there would be no new ways of thinking, but unless there were an evaluation of the various manifestations of imagination and a selection from among them of those corresponding to actual facts and needs, imagination would lead to disaster about as often as to advantage.

Originality should not be cultivated for its own sake. — The greatest thinkers have not been those who cast aside most ruthlessly all established modes of thought. Great thinkers are rather those who display imagination in some critical situation where others have failed to display it. Newton, as we have said, mastered much of the established scientific knowledge of his time, and most of it he accepted.

But here and there he felt that there was a weak link or a gap in existing knowledge, and that is where his imaginings began. He imagined that the falling apple and the movements of the heavenly bodies might be operating according to a single law of gravitation, a supposition he was later able to prove. Now it was not that Newton imagined so freely or so extensively, but rather that he imagined *so well* in regard to such a crucial scientific problem that makes us revere his memory. Shakespeare did not hesitate to borrow complete plots from other writers. He knew where he could get a good plot whenever he wanted one, and to those sources he went. His own imaginative efforts were saved for the concoction of those details of dialog and action that make all the difference between life and some dead chronicle.

A struggle for originality which is carried on always and everywhere, whether or not there is a need for it, is an unfortunate affair. It is such a waste of energy! Quite frequently a kind of false pride makes a man unwilling to accept any mode of thought that is not a product of his own imagining. He does not care greatly how or to what end he modifies the thoughts of others, if only he modifies them. We have all met individuals with characteristics similar to those which William James, in his "Letters," attributed to a certain professor. "—— has the most prodigious faculty of appropriating and preserving knowledge, and as for opinions, he takes *au grand sérieux* his duties there. He says of each possible subject, 'Here I must have an opinion. Let's see! What shall it be? How many possible opinions are there? three? four? Yes! just four! Shall I take one of these? It will seem more original to take a higher position, a sort of *Vermittelungsansicht*[1] between them all. That I will do, etc., etc.'"

[1]A mediatory attitude (a view).

Inspiration and deliberate creation compared. — Everyone is familiar with the fact that new combinations of ideas sometimes occur spontaneously and with a minimum of effort and at other times only as the result of a long and deliberate process of reflection. There have been very effective thinkers who have relied to an astonishing degree upon the immediate and spontaneous type of production. This is said to have been true of Poincaré, the eminent French mathematician. He often began writing a scientific article without any conclusion in mind, in the hope that appropriate ideas would come to him as he wrote. If the ideas failed to take form easily he would abandon the paper temporarily and count upon having better fortune when he resumed work upon it.

The creative activities of the composer, Mozart, also took this spontaneous, inspirational form. "When I am feeling well," he says, "and in good humor, perhaps when I am traveling by carriage or taking a walk after a good dinner, or at night when I cannot sleep, my thoughts come in swarms and with marvelous ease. Whence and how do they come? I do not know. I have no share in it. Those that please me I hold in mind and I hum them, at least so others have told me. Once I catch my air, another comes soon to join the first according to the requirements of the whole composition counterpoint, the play of the various instruments, etc., etc., and all these morsels combine to form the whole."[1]

So spontaneously did his poems come to him that William Blake, an English writer and painter, believed that they must have a supernatural origin. While we ourselves should hardly fall back upon such an explanation, his own statement

[1] Quoted by F. C. Prescott, *The Poetic Mind*, p. 42 (The Macmillan Company).

is worth considering, because it gives a vivid picture of an extreme case of the so called inspirational form of imagination. "I have written this poem (*Jerusalem*) from immediate dictation . . . without premeditation and even against my will . . . I dare not pretend to be other than the secretary. The authors are in eternity." Poetry and art, he says in another place, are least creations of the poet or artist, but of powers beyond control. "A poem is not written by the man who says: I will sit down and write a poem; but rather by the man who, captured by rather than capturing an impulse, hears a tune which he does not recognize, or sees a sight which he does not remember in some 'close corner' of his brain, and exerts the only energy at his disposal in recording it faithfully in the medium of his particular art."[1]

It is a popular belief that this inspirational type of production, during which the thinker has the feeling that his imagination is running freely and beyond control, is a necessary characteristic of the great man, especially if he be working in some field of art. However, substantial evidence for this belief is lacking. Exquisite works of art may be produced by imaginative processes that are of the most deliberate and voluntary sort. There have doubtless been many deliberate workers in the various fields of art, but Emile Zola is, perhaps, the most often cited to illustrate this point. So rational and deliberate were his acts of creation that he likened himself to a scientist conducting an experiment. He observed in great detail the lives and surroundings of the type of people about whom he wished to write. To do this he might actually go to live among them. "After spending two or three months in this study," he tells us, "I am master of this particular kind of life, I see it, I feel it, I live in it in imagination, and I am certain of being able to

[1] Arthur Symons, *William Blake*, pp. 14–15 (E. P. Dutton and Company).

give my novel the special colour and perfume of that class of people. Besides, by living some time as I have done amongst this class of people, I have made the acquaintance of individuals belonging to it, I have heard real facts related, I know what occurs there as a general rule, I have learned the language which they usually talk, I have in my head a quantity of types, of scenes, of fragments of dialogue, of episodes, of occurrences, which form a confused story made up of a thousand unconnected fragments. Then there remains to be done what for me is the most difficult task of all, to attach to a single thread, as best I am able, all these reminiscences and scattered impressions. It is almost always a lengthy task. But I set to work upon it phlegmatically, and instead of using my imagination I use my reasoning faculties. I argue to myself, I write my monologues word for word, just as they occur to me, so that, read by another, they would appear strange. So-and-so does this or that. What would be the natural result of such-and-such an act?"[1]

To most of us the deliberative, reflective, painstaking sort of imaginative creation seems natural enough. It is the non-deliberative, spontaneous, inspirational sort of creation that calls for explanation. And it is creation of this latter variety that is most likely to be explained in terms of some mysterious and supernatural force making itself felt upon the mind of the thinker. But there are certain important facts which indicate that inspiration is no more supernatural than any other form of imagining. In the first place, those who are unskilled in the ways of art or literature seldom come forth suddenly with an epoch-making creation. Inspiration occurs most frequently among those who are in the habit of getting inspired; that is to say, among those who have

[1] R. H. Sherard, *Emile Zola*, pp. 135–136 (London, 1893).

worked and meditated in the field of poetry, painting, or some other art. If inspiration were an external force affecting the individual, we should hardly expect it to be so selective. In the second place, the subject-matter of inspired ideas is always closely related in some way to the life, surroundings, and thought of the artist. Even such a spontaneous producer as Blake spent much time studying the subjects which his poetry and painting involved. He attended the picture galleries and discussed their contents in detail with his friends. Before painting on the subjects of Dante's work, he undertook an extensive study of the Italian poet. In the third place, the products of inspiration, as a rule, have to be subjected to elaborate criticism and revision. All of these facts make the spontaneous type of production seem very much a matter of this world of natural events.

Why imagination sometimes seems so spontaneous. — While we are justified in putting aside as false any supernatural explanation of inspiration, the problem still remains of establishing the reason why imaginative creation does, at times, proceed so spontaneously and smoothly that it seems directed by external forces. We saw in Chapter IX that our ideas are associated with perceptions and other ideas, and that when an idea is aroused, it is aroused by some experience which has been associated with it. Now, as we pointed out, there is a clear, logical connection between most ideas and the experiences which have become associated with them. Under such circumstances we are not baffled at the occurrence of an idea. If, for example, a warm spring breeze against my cheek arouses in me ideas of the coming summer and if these, in turn, arouse ideas of what I intend to do during the vacation days, I am not likely to feel that these ideas have been given me by some external agency. Such a succession of thoughts is what I have learned to expect of

myself and therefore their occurrence seems perfectly natural. I should never think of explaining their rise as due to supernatural causes. But, as we have also noted, it is possible for any idea to become associated with any experience. This allows for associations where the logical connection is not so evident. Consider Shelley's lines about the snowdrop and the violet:

> And their breath was mixed with fresh odor, sent
> From the turf, like the voice and the instrument.

One in whom the odor of flowers and turf arouses ideas of interpenetrating voice and instrument might easily feel that this unusual association could not be explained in terms of some past experiences he has had. Try as he may, it is not likely that he can find in his own history the specific origin of this association. Thereupon he will be tempted to explain it in terms of some outside agency. Yet it is certain that somewhere in his past experience there lies an explanation for this particular association. The difficulty is that his memory is not complete enough to reveal the complete history of his experiences with flowers and instruments.

There is another peculiarity of spontaneous creation, besides the fact that it seems so detached from the ordinary ways of thinking and from any specific past experiences which the thinker has had. During a period of so-called inspiration, ideas may be aroused quickly, abundantly, and without any sense of effort. Very often the explanation for this facility of thought lies simply in the fact that the thinker has got himself into a physical and mental condition where stimuli, which might arouse irrelevant thoughts, and so disrupt the ready flow, are lacking. If one gets into the habit of thinking in a particular room and at a definite hour, his presence in that room at that hour may be enough to set up a ready flow of thought. Fixed habits of work have been

frequent among great thinkers. "Many writers feel the need of being in particular spots, of using peculiarly colored paper or ink before they can do well. Rousseau found composition difficult unless he was walking. Neander composed best lying on his stomach. Coleridge liked to compose best while walking over uneven ground. Sheridan composed at night with a profusion of lights about him. Lamartine had a studio of tropical plants. Dr. George Ebers imagines himself more at liberty to write with a board on his lap than at the desk. Vacano composed at all times, but the place he was in was important, and he could write best in the hubbub of peasant life near an old mill. Maurice Jokai must have fine pens and violet ink. These habits, however acquired, evidently have great power of distracting the attention if they are not satisfied, and so retard work."[1] And, we might add, these habits may come to be so associated with creative thinking that they seem automatically to set the imagination free. We might cite one more illustration of a very modern variety. A certain English statesman is a public speaker of wide reputation. Set him on his feet before a great crowd, and his eloquence is sure and unhesitating. Not a long time ago, so it is said, this Englishman delivered his first radio address. He was taken alone into the sending-room, shown his position, and told to begin his speech. Not for years had words failed him, but here, in this strange setting, his voice seemed paralyzed. He lacked the associative cues to set him off, and he fought for his first words as does a man who has never been called inspired.

C. Imagination and Reality

Imagination is related to the more outward forms of action. — Reasoning is a search, carried on in terms of

[1]Bergstrom, *American Journal of Psychology,* VI, p. 267.

thought, for the solution of some problem. The solution may finally turn out to be a way of moving rather than a way of thinking, but the discovery of it is first made in terms of imagination. I imagine myself taking the new route to town before actually embarking upon it.

In our next chapter we shall return again to this matter of reasoning. In the meantime there are two other sorts of imaginative activity whose relationships to our conduct as a whole require our consideration. These are fantasy and the dreams in sleep.

Fantasy related to outward action. — Fantasy, or day-dreaming, like reasoning, develops in the presence of a problem, although that problem may not be specifically recognized by the dreamer. Fantasy occurs when the individual has impulses to express and, because of external conditions or other impulses which he possesses, cannot express them in any complete way. The child at play would be a warrior and kill his foes, but various factors prevent him from carrying out these impulses. In the first place, there is no war about him. In the second place, he lacks the tools for murder. And, in the third place, he has acquired a collection of social habits, commonly called a conscience, which would hold him off from slaying human beings. By means of make-believe, he partially solves his problem and becomes, within the confines of his own imagination, a bloody warrior. There is hardly one of us who does not hope that some day great wealth will, in some way, come to him. But this impulse to possess wealth and the things that wealth can buy finds no satisfactory expression in the mere act of waiting for some possible stroke of good fortune. And there are many harboring such a hope who for one reason or another are prevented from going out in active pursuit of what they desire. What is there for them to do? They

can engage in day-dreaming, and that is what most of them do. In this way their problem is at least partially solved. In imagination they do what their desires dictate, only they do not do it as overtly as complete expression of those desires would demand.

Fantasy, although it grows out of impulses toward more outward forms of behavior, does not ordinarily result immediately in outward expression. An exception is the make-believe play of children, but even there the outward expression is a mere accompaniment and vivifier of imagination. In fact, fantasy is, in its most essential nature, a substitute for immediate, overt action. Although fantasy is a substitute rather than a preparation for immediate, outward action, it is often, and in a very genuine sense, a preparation for outward action in the more distant future. A boy who desires to be a physician cannot at once express that desire in the form of overt behavior. He can, however, engage in day-dreams about the day when he will actually attend the sick and the injured. Such day-dreaming will not issue immediately into outward behavior as does my imagining of a possible route to the place I wish to reach an hour hence. But it may prepare for outward behavior which is to come years hence. It may keep the dreamer on the path toward a remote, but actual goal, by keeping clearly before him the object of long and sometimes tedious courses of study, the connection of which with medical practice is not always too evident to the student.

Dreams and overt action. — The contents of dreams in sleep are so vivid and yet often so disordered and grotesque that they have for centuries furnished one of the most interesting of scientific problems. One of the first facts to notice about dreaming is that it is definitely related to internal and external stimuli acting upon the sense-organs

while we sleep. The other night I dreamed, just as I was falling asleep, that two large strips of bacon hung before my face. Before retiring I had rinsed my mouth with salt water, and the salt was still acting upon the organs of taste in my tongue. Almost everyone has dreamed he was out in a blizzard, only to find, upon awaking, that he has kicked off the covers. Almost everyone too, has dreamed of a fire or of going to church, only to awake and find that the alarm clock is ringing. What we dream is also determined by internal stimuli. Whether our dreams are happy, sad, or frightful depends to a considerable extent upon the functioning of our digestive and circulatory organs.

Dreams are related to our waking life in that they express, if in only a partial fashion, impulses toward completer and more overt action. Dreams of sleep, like day-dreams, often take the form of the carrying out of some cherished desire. Everyone, now and then, achieves glory in his dreams, and the specific nature of that achievement — whether it be social, political, military, athletic, or financial — very often is in line with his acknowledged ambitions.

About as frequently, however, our dreams are of affairs for which we would not want to admit a desire. We are inclined to dream about things that worry us. A man was recently worrying over whether or not he would obtain a position upon which his hopes were fixed. Many of his dreams were about this matter. Sometimes he dreamed that the position had been successfully secured, but at other times he went through the great disappointment of losing it.

Dreams do not prepare for action as typically as do other manifestations of imagination. They are, as a rule, less immediately related to outward action even than day-dreams. The immediate expression which dreams get in sleep-walking and talking are striking largely because they are exceptional

cases. Most dreams lack such overt expression. Sometimes a person dreams the solution for some problem, which he later successfully applies in waking life. But here again we have a connection between dream activity and outward behavior which is striking simply because it is so exceptional.

Imagination is sometimes personal, sometimes impersonal. — The imaginings in which we indulge are often, as we have said, set up by some problem, an immediate or more remote solution for which seems to be required. Except in persons of high intellectual development, these are practically always personal problems, and the imaginings which they instigate have a direct reference to personal welfare and advantage. The hungry man either imagines a method for actually obtaining food for himself or else indulges in a day-dream in which he imagines himself enjoying a feast.

Miss Bertha Ten Eyck James has given me an account of the day-dreams of a little girl of eight: "Her fantasies are of the simplest type, typically wish-fulfillment, centering about herself and her family. In this series of day-dreams she has all the things that she wants, long hair, beautiful clothes, a pony, a wonderful house, travels. She does not have to go to school, but is tutored by a young army officer. She tells herself about her home and her travels as if it were a story, but at the same time she sees everything as it happens although occasionally the imagery is not what she wishes, and she may see a stormy sea when she tries to picture a calm one. This child seems to derive very great pleasure from these fantasies, and plans new ball rooms for her house, new comforts for the automobile, quite as if they really existed, but she does not confuse fact with fancy nor attempt to make other people believe her dreams."

Day-dreaming is not always so personal. A frequent type of day-dreaming is one in which the characters, as well as the events, are products of imagination. The dreamer may consider himself as merely an onlooker, if, indeed, he does not entirely suspend interest in himself. Such an attitude must be present in the case of many authors of fiction, because they seem to center their interests at different times around the careers of characters having practically nothing in common. But even in children this impersonal attitude may be found. Many children create for themselves imaginary companions, and very often they imagine their own hopes realized, not by themselves, but by these imaginary companions. A friend tells me that, as a boy, he was greatly troubled by the swarthiness of his complexion. Instead of dreaming that he, himself, was blond and ruddy as he would have liked to be, he imagined a companion who possessed these desired qualities. Such day-dreaming is not, of course, as impersonal as it might be; the adventures of the imagined companion are very plainly those that the dreamer, himself, would like to have.

A higher stage of day-dream development is reached when events as well as characters are relatively foreign to the wishes and personal traits of the dreamer. Another example from Miss James: "The three girls and one boy in this group, varying in age from fifteen to eight (the boy youngest) evolved a type of group fantasy in which each one assumed a character, and by conversation and occasional narrative, worked out the plot of a story. The eight-year-old boy and his sister of fifteen began this, and together they built up one fantasy that had at least fifty characters and which they continued for seven years until it was largely crowded out by other interests." Day-dreams of this sort have reached a stage far beyond those of the more primitive variety

where one simply imagines himself achieving some personal wish.

Probably the most complete abstraction from the personal occurs in the imaginative activities of philosophers and men of science. Their construction of theories and the like goes beyond their personal concerns, and often, too, beyond the immediate concerns of the human race. A scientist of note recently devised a method for measuring the diameter of a star millions and millions of miles from the earth. Thinking about such topics stands in marked contrast to thinking about a new suit or a raise in salary.

Imagination may become an end in itself. — For the scientist and philosopher imagination may be cultivated for its own sake. The philosopher weaves an intricate theory about the ultimate nature of the universe, not because he wishes things were as he imagines them to be in his theorizing and not because that theory represents some possible direction for his more outward behavior, but simply for the love of the weaving. The artist, too, may come to that state of affairs where he is more interested in the task of imaginative construction than he is in what, in the world of actuality, is represented by those constructions.

> But each for the joy of the working, and each,
> in his separate star,
> Shall draw the Thing as he sees it for the God
> of Things as they are!

This intellectual detachment, this interest in thought for thought's sake, is almost a requisite for the higher forms of intellectual and artistic achievement. Truly, the greatest of men cherish the applause their achievements bring, but a continuous consciousness of a desire for personal praise does not leave sufficient energy for highly disinterested thinking. Although there are perhaps few men who have been without

a desire for applause, many have kept that desire subservient to the greater one of pushing forward the accomplishments of their imaginations in the way that seemed to them fitting. Such men are those who are unappreciated by their own generation because their thinking has reached a stage which will have meaning for the mass of people only in the years to come.

The thinker cannot afford to lose touch with reality. — Imagination may be free from and unfettered by the more immediate matters of everyday life without getting entirely out of touch with reality. The philosopher who constructs what seems to him the truest theory of the world and all its occurrences is not pulling away from reality because he neglects in his intellectual endeavors his own immediate welfare. In fact, it is reality that he is trying to comprehend. The artist who makes new experiments with tone and color is not ignoring the more actual affairs of life. Music and painting are realities, and he is simply trying to extend their scope. Thus may the bounds of human enjoyment be extended.

There are unfortunate instances, however, where imagination does seem too disconnected from reality. Day-dreaming is sometimes an easy way out of the difficulties of life; if it becomes so satisfying to the individual that it causes him to relinquish his efforts, then it is a dangerous business. The imaginings of the student by means of which he pictures the goal for which he is striving are all right in themselves. They may, indeed, serve to keep that goal before his mind and give him the courage to face the tedium and discouragement of long years of study. But let him fail to realize that his day-dreams are only dreams, that hard work alone can make them an actuality, and they are likely to be a genuine handicap.

Summary of the Chapter

1. Imagination is ideation representing objects or events which have not, in their imagined form or arrangement, been present in the actual experience of the imaginer. This ideation may represent present, past, or future.

2. There are always present in imagination some ideas which represent experiences as they have actually occurred. In imagination, however, there is a preponderant reference to that which lies beyond the imaginer's personal experience.

3. In the last analysis every element in an act of imagination can be traced back to personal experience, but it is the essence of this type of thought that these elements receive a novel arrangement. Such novel arrangements of thought are essential for progress.

4. Our thinking tends to take on novelty when, in reasoning or day-dreaming, we seek the solution of problems.

5. Our ways of thinking are also modified by our contacts with others in conversation, literature, and the like.

6. The amount of originality which we show depends upon the breadth of our experience. Clearly the possibilities for new arrangements of our ideas depend upon how much we know.

7. Originality also depends upon the particular combinations of experiences we have had. Contact with farming would be more likely to make a banker rearrange his ideas of banking than would contact with tennis.

8. A habit of not accepting experiences at their face value, but of looking behind them for their less evident meanings is one way in which originality is secured.

9. Originality of thought is relatively rare because novel

experiences are rare in most lives and because custom and tradition tend to make us take things as we find them.

10. Originality is not of value in and for itself. The ravings of a diseased mind may be original. Originality which is worth anything serves some purpose.

11. Creative imagination sometimes runs smoothly and spontaneously and sometimes it is accompanied by strong feelings of effort and deliberation. This spontaneity does not, itself, tell us the value of the products of imagination. Great works of art, for example, are now produced by smooth-flowing, and again by effortful, imagination.

12. Spontaneous, or smooth-flowing, imagination is often thought of as due to a supernatural inspiration. Careful scrutiny shows that no such supposition is necessary. For one thing, the fact that the inspired one has usually spent much previous time in meditating about his subject indicates that spontaneous imagination is not quite so spontaneous as it seems.

13. Imagination, like other types of ideation, has an effect upon our more outward forms of action. It also expresses tendencies toward such action. This is particularly true of imagination as it occurs in reasoning, but it is also true of fantasy and dreams.

14. Imagination is either personal or impersonal. Usually some education is required before an individual is inclined to concern himself with topics of thought remote from his personal life, but in the highest intellectual endeavor thought is characteristically of this impersonal sort. This does not mean, of course, that the more worthy types of thinking are unconcerned with reality, but merely that they are to a considerable extent free from the influence of immediate and trivial matters.

PROBLEMS

1. Give an account of three cases of imagination from your own experience, one referring to the past, one to the present, and one to the future.

2. Which does your imagining most often represent: the past, the present, or the future? How do you explain this?

3. (*a*) Describe some event which you have witnessed in the past twenty-four hours. To what extent does this act of remembering involve imagination? (*b*) Describe some event which you have never witnessed. To what extent is this imagination based upon experiences which you actually have had?

4. How do your powers of imagination affect your attitude toward your later career?

5. What are some of the problems which, during the past twenty-four hours, have set you to imagining?

6. Which of your school subjects has enabled you to think about matters furthest from your personal experiences? Why is this the case?

7. If one is ambitious ultimately to contribute in an original manner to business, literature, or some other field of human endeavor, what is the first step to be taken?

8. Why is it that the possession of mere information will not, of itself, make a man an original thinker?

9. If you were about to purchase an automobile, what would you take into consideration besides originality of design? Under what circumstances is originality of design a desirable feature of an automobile?

10. Why do you suppose it is that the rest of the world has such a strong inclination to explain the imagination of a great man as due to a supernatural inspiration?

11. Is the value of a piece of literature affected if we are able to explain the imagination of its author in natural rather than in supernatural terms? Defend your answer.

12. Give an account of one of your favorite day-dreams. Show how it expresses your desires. Show how and to what extent it affects your actual behavior.

13. Give an account of one of your dreams in sleep and the stimulus which you think aroused it. How did this dream fit in with the hopes and fears of your waking life?

14. Which type of imagining is likely to make for the greatest happiness in the long run: that which is concerned with relatively personal matters, or that which is concerned with relatively impersonal matters? Why do you think so?

REFERENCES FOR FURTHER STUDY

Sully, *The Human Mind*, Vol. 1, pp. 362–371; or *Readings in General Psychology*, Ch. XIV, Selection 1, p. 338 ff.

Pearson, *The Grammar of Science*, pp. 30–31; or *Readings*, Ch. XIV, Selection 2, p. 345 f.

Bain, *The Emotions and the Will* (3d ed.) pp. 427–432; or *Readings*, Ch. XIV, Selection 3-A, p. 347 ff.

Readings in General Psychology, Ch. XIV, Selection 3-B, p. 351 ff.

CHAPTER XII

REASONING

Questions to Keep in Mind while Reading this Chapter

1. What is reasoning?
2. What is required for accurate reasoning?
3. What is the use of reasoning?

A. The Nature of Reasoning

Ideation is a short cut in problem solving. — When the business executive considers the possible means of communicating with a lieutenant in another city and chooses from among the ideas that come to him the one which it seems wisest to put into action, we have a first-rate example of the process of reasoning. Another example is furnished by our earlier description of a search, carried out in thought, for the best and shortest route to some destination which one is called upon to reach. The procedure of reasoning may be brought into contrast with the usual problem-solving activity of animals. A dog trying to get out of a cage or problem box does not sit down and reason about the matter. He simply puts into immediate and full operation one after another of a series of movements. Finally, among these movements there may appear the

proper one to spring the latch. A striking fact about the dog's behavior is the enormous loss of energy in movements that have not the least chance of solving his problem. It is quite evident that these movements are not preceded by ideas that represent them. Most of them, if anticipated in that way, would never take place. But in the rational method of problem-solving, this anticipation of completer action by ideas of that action and its possible consequences is the outstanding feature.

The saving of time and energy afforded by reasoning, when it can be employed, is very great. If the business executive had actually to try out all of the methods of communication that he could think of, his message to his lieutenant would be a costly affair from several standpoints. He might have to send telegrams to perhaps two addresses, dictate a letter, and then try "long distance" before solving his problem. If one could not select the best route to his destination without trying out all possible routes, he would either waste much time and energy or, as would be more likely, he would stand little chance of traveling over the best route.

Reasoning prevents us from committing many serious errors. If one actually carried out all the acts he ever thinks of, he would soon be in a serious plight. As a result of this process of reasoning, however, one is frequently able to realize the folly of an act through a consideration of a mere idea of that act. Thus the act itself may happily be avoided. When one considers ideationally the possible ways of acting in a problematical situation, each idea of action is usually accompanied by certain ideas of the consequences of the action. When these latter ideas represent unfavorable consequences, the act which has been thought of is not likely to get into operation.

A third advantage of reasoning is that, by virtue of this

process, we are able to prepare for situations which have not yet arisen. I am able through reasoning to conclude that the owner of my apartment is likely to raise the rent this coming May. This raises the question as to whether I shall accept the increase or look for other living quarters. Through further reasoning I am able to decide which of these alternatives will probably be better in the long run. As a result, I am fully prepared to act and to act promptly when the actual notification of the increase in rent occurs. Often there is no time for deliberation after a problem has actually arisen. If, in such an event, we have already concluded in thought that this problem would arise, and if we have already reasoned out the best way of meeting it, the appearance of the problem itself does not force us into a thoughtless, impulsive decision.

Reasoning and action are usually mixed together. — There are definite limits to our ability to substitute ideation for action in the solution of problems. Often it is impossible to foresee the results of a thought-of act without putting it into execution. Psychologists have studied the process of reasoning utilized in the solution of mechanical puzzles. In the case of such problems the limitations of ideation stand out very clearly. Rarely, if ever, does a person solving one of these puzzles abstain from all action until he has a correct idea of the solution. It is the typical thing for him to do much more fumbling than reasoning. Indeed, the attack upon the puzzle frequently assumes such a random character that he who gets the solution is as surprised as anyone when it appears.

In the practical affairs of life it is of the utmost importance that we know how far we can trust mere ideation and at what point it is wise to test our ideas in action. If our problem is of a very unfamiliar type, we are usually unable

to think about it either clearly or exhaustively. This is illustrated by the mechanical puzzles discussed above. Such a puzzle presents a problem so novel that one is forced almost immediately away from thought and into random movements. Sometimes the solution is hit upon, as we have seen, directly by means of such random movements. At other times the movements may serve simply to acquaint one with the nature of the problem. But in any case, reasoning about relatively strange matters requires a certain amount of checking up as one goes along.

Problems of great complexity also stand in need of something more than purely ideational attack. No builder of motor cars would design a new engine and put it on the market without giving it some sort of practical test. There is common admission in the automotive industry that the problems of engine design are far too complicated to be solved in terms of ideas alone. Some important difficulties are certain to exist in the very best of plans, and only by putting the plans to the test of practice can all of them be met and overcome.

We reason only in face of difficulties. — The average person during his day's work does less reasoning than he thinks he does. When a man gets up in the morning, he usually does so without any intellectual consideration of the pros and cons of rising. When he dresses, has his breakfast, takes his train for the city, makes his way from station to office, he does these things without reasoning about them. He possesses fairly fixed habits which successfully carry him through these ordinary activities. It is only when some novel demand is made upon him, some demand which his stock of habits will not readily meet, that reasoning occurs. As long as his dressing runs in its accustomed manner, he will not reason about it; but let him lose a collar button, and

reasoning may begin. Shall he send to the corner store? No, the store is not yet open. Shall he look about for that other one he had? No, he remembers that he threw it away last week. But he can button his overcoat up around his neck. This will be all right until he gets to the office, and, before getting there, he can stop in at a haberdashery in the city, because by that time the stores will be open. When this problem that has given rise to his reasoning has been thus satisfactorily solved, this particular process of reasoning will cease.

In reasoning there is a direct facing of the problem. — Not all ideation is reasoning. Day-dreaming is, in a way, problem-solving through the use of ideas. The poor man constructs out of ideas a world in which he has plenty of money; the weakling constructs out of his ideas a world in which he wins fame for his physical strength; and the little child dreams himself into the importance of a grown-up. The poor man is beset with poverty, the weakling with his physical impotence, the little child with a lack of various privileges, and their day-dreams are partial solutions for their problems. There is, nevertheless, an important distinction between this sort of thinking and reasoning. In reasoning one faces the problem squarely before setting out on an intellectual search for possible solutions, and throughout that search and the process of evaluating the ideas which are entertained, there is a regard for just what one is trying to accomplish by this thinking. While day-dreaming gets its start from some problem confronting the dreamer, there is seldom any out-and-out realization of what he is working toward. The little girl who supplies herself through fantasy with long hair, beautiful clothes, a pony, and other objects of her heart's desire hardly recognizes in any clear fashion the real source and motive of her world of thought. This is totally unlike

the case of the executive thinking out a method of communicating with a man in another city. He knows very definitely that he is thinking in order to work out this problem of getting in touch with his lieutenant. Such ideation as this, where the problem is persistently and plainly in view, is the kind to which the term *reasoning* is most often applied.

B. The Value of Reasoning

Reasoning is itself no index of efficiency. — It is sometimes assumed that he who spends much time in reasoning is, on that very account, a highly efficient person. Our description of the conditions under which reasoning occurs gives us a hint that that assumption cannot be accepted without some qualification. When one is prepared to meet a situation immediately and adequately, that situation does not furnish a problem and no reasoning process is set up by it. Only when one meets a situation with some degree of *inadequacy* is reasoning required. We might just as well say that the random barking and running about of a dog seeking escape from a cage is a sample of that dog's most efficient sort of behavior, as to say that a person is most efficient when he is engaged in reasoning. When a person is reasoning we may be sure that he is balked, and there are a great many things in life by which he cannot afford to let himself be balked.

Sometimes we see this respect for reasoning for its own sake leading to very unfortunate consequences. There are parents who believe that their children should decide upon obedience, even to perfectly just demands, through the processes of their own reasoning. The chief result is that these children argue and haggle to a point of impertinence over every little moral issue of their lives. If requested not to interrupt the conversation of their elders, they always

continue their interruption by demanding all the reasons why they should not interrupt. All of us are acquainted with adults, too, who suffer from reasoning where reasoning should be unnecessary. The well-trained individual has, for the usual intellectual and moral problems that are likely to arise in his life, solutions which are ready at hand and do not have to be searched for even in thought. The better equipped one is in a certain department of life, the greater the range of problems in that field for which immediate judgment is adequate and in regard to which it is unnecessary to reason.

The glory of reasoning, then, is not simply that it occurs. Very often the fact that a man reasons in a given situation indicates lack of competence rather than possession of it. Consider a person who debates with himself as to whether it is his duty to look after his old parents! But the glory of reasoning is this, that it is an admirably economical method of solving a problem for which one does not have a ready solution. As long as human beings have their present limitations they will never acquire, no matter how thorough their training, solutions for all the problems they will be called upon to meet. And, granted that there will always be problems to solve, the reasoning process, as we have already seen, has advantages over the non-intellectual method of working out solutions.

Efficiency of reasoning is measured by its quality, not by its quantity. — If two men come upon a problem for which they have no ready-made solutions, they will probably begin reasoning. Let us assume that the problem is that of choosing a proper investment for their savings. Let us assume, further, that the conclusion reached by one proves fortunate and that the conclusion reached by the other results in the loss of his money. The difference in the outcome of the

reasoning of these two cannot be explained simply in terms of the amount of reasoning which each applies to the problem. The one whose reasoning turns out badly quite as likely as not, considers just as many possibilities and engages in just as much ideational activity as the one whose reasoning is more successful. The accuracy of reasoning is determined, not by its elaborateness, nor by the number of ideas involved, but rather by what kinds of consequences it brings. And these consequences are determined more by *what* ideas one entertains and by which of these are accepted and which rejected than by the number of ideas considered. The unsuccessful reasoner may think of fifty possible investments to five thought of by the successful reasoner, but the latter's choice from among these possibilities is sound and the former's is not.

Now it is by no means intended by this to imply that elaborate reasoning, in which a great many ideas occur, is generally inaccurate reasoning. Our point is simply that the elaborateness of reasoning does not itself indicate efficiency, and that it is often possible to reach as sound a conclusion from a simple reasoning process, involving few ideas, as can be reached from one of greater complexity.

When is extensive reasoning effective? — It is difficult to lay down any rule as to how many possibilities should be considered in the solution of a problem in order to obtain the best results. The proper answer to this question depends upon the individual, his training, and the nature of the problem. Some persons seem to need time for meditation, while others are able to jump to conclusions without any apparent sacrifice in accuracy. Much, of course, depends upon the training a person has had. The fact that the fortunate investor in our illustration needed to consider only

five possibilities may well have been attributable to his training. He may have known what securities he was really in a position to evaluate, wherefore the long list of stocks and bonds that occurred to the other man did not occur to him. An experienced merchant may decide upon his purchases for next season's stock without engaging in anything elaborate enough to be called reasoning. The beginner in the same business, on the other hand, might be expected to buy wisely only if he faced and considered in some detail a large number of facts.

As a rule, it is true that problems of great complexity demand more reasoning than simpler ones. We believe that practically anyone will cast his vote better if he reasons about the political issues involved and that he will choose his career more wisely if he reasons about his various opportunities. The problems involved in these choices and conclusions are quite complicated.

This fact that reasoning is especially necessary in the case of more complicated problems is in no way a contradiction of our statement that reasoning is in greater need of testing in action when the problem is unfamiliar or complex. The more complex the problem, the more need there is for both reasoning and the testing of reasoning in action.

There are also problems that are less likely to be properly solved by much thinking than by little. These problems are simple ones. The number of ideas relevant to them is limited, and too prolonged thinking about them is more likely to confuse the situation than to furnish grounds for accurate conclusions. In the psychological laboratory, experiments are frequently carried on in which the subject is directed to decide which of two weights, lifted in immediate succession, is the heavier. Similar experiments are carried out in which the subject is directed to decide which of two

lines shown together is the longer. Simple decisions of this type are more accurate if not made too slowly. One reason for this is that the data bearing upon this simple problem are few, and they are completely presented with the pair of weights or lines. Meditation may bring fresh facts to the process of comparison, but they are more likely to be irrelevant and distracting than relevant and helpful.

Each individual really has to discover for himself just when it is well for him to meditate and when it is not. For most players only a very brief amount of meditation is desirable before making a shot in golf. It may prove beneficial to consider whether the grip is right and whether the eyes are on the ball, but too prolonged thought is almost sure to introduce ideas of what a good or poor shot will do to the score, and such ideas are very likely to interfere with efficiency. But if we are confronted with a complex problem, such as planning a political campaign, it is hardly possible for one to think too thoroughly. Of course, the problem that is complex enough to demand deliberation on the part of one person may be too simple to make much thought desirable on the part of another.

What one reasons about is a clue to his intelligence. — We have shown that the amount of reasoning done is not an accurate index of one's general level of efficiency. A more important question is that which asks how well one reasons and what results one achieves by reasoning. Another question of consequence is in regard to *what* one reasons about. Let us suppose that in a psychological experiment we give a man a list of words, one after another, to each of which he is to give the opposite in meaning. If, when we give him the word "short" or the word "black," he has to reason about what word has the opposite meaning, we are not likely to put him down as possessing a phenomenal

amount of intelligence. Now let us suppose that we present another individual with this problem:

> A mother sent her boy to the river and told him to bring back exactly 7 pints of water. She gave him a 3-pint vessel and a 5-pint vessel. Show me how the boy can measure out exactly 7 pints of water, using nothing but these two vessels and not guessing at the amount.

In this case an intelligent person would be more thoughtful about answering than an unintelligent one. In fact, it requires a certain amount of intelligence to see the difficulties involved in a problem of this type.

Thus it is true that, although reasoning is an indication that a person is confronted with a problem for which he lacks a ready-made solution, thinking is as prevalent, and probably a good deal more prevalent, among the intelligent than among the unintelligent. While the growth of intellectual competence means the acquisition of many efficient habits which will be called forth immediately and without thought, that same growth makes it possible for us to see problems which would, in a stupider state, have been passed by. Preoccupation with problems that escape the notice of most people is one of the surest signs of a high state of intellectual development.

Men had known for ages that worms and maggots appear in decaying meat before the question as to how they got there became a genuine problem. It was not until a late period in human development that the position of the earth in the universe was actually looked upon as a problem requiring deliberate thinking. In ancient times men simply accepted the earth as the center of things. The earth's position did not become a problem until men realized that this view was not the only possibility. To reach that realization required the possession of considerable knowledge and astronomical

skill. Most people today have never been bothered by the question as to how we see each object singly, although we look at it with two eyes. The naive and immediate answer might be that we see only one object, that what we see with the two eyes is one and the same thing. A little more experience, however, shows us that the matter is not so simple as it seems. Put up either forefinger directly before and about eight inches away from your nose. First close the right eye and look at it; then close the left eye and look at it. When the left eye is open, you will see the front and part of the left side of the finger, and when the right eye is open, you will see the front and part of the right side. But in spite of this difference between the view of the finger as seen by the left eye and the view seen by the right, only one object is seen by the two eyes when they work together. Here is a problem that one would not even reason about unless he had made considerable progress along the pathway of knowledge and intelligence.

C. The Basis of Reasoning

First requisite for reasoning is possession of information. — Some problems cannot be reasoned about until one has reached a certain stage of intellectual development and has accumulated a considerable amount of information. The process of reasoning consists in the consideration of a number of ideas and the choice of those most suited to one's purposes of action or thought. The acquisition of ideas is necessary not only for the recognition of problems worth thinking about but also to furnish materials, that is, ideas, wherewith we can think.

Ideas come from experiences of everyday life. — By far the majority of the ideas that occur in the process of reasoning are picked up out of the casual experiences of everyday

life. The ordinary man, in reaching a decision as to how to invest his savings, considers the securities he has seen advertised, the securities his friends have bought, and the like. This information is usually not collected while he is in a frame of mind intent upon exactness. It is made up of a mixture of true ideas and false ideas which have, so to speak, stuck to him as he has gone through the usual experiences of his life.

Reasoning based upon ideas thus casually acquired may lead to conclusions of marvelous insight and accuracy. The first ideas about arithmetic, geometry, astronomy, came out of the ordinary man's workaday contacts with the world. Arithmetical reasoning was not prepared for in the very beginning by any formal search after the properties of numbers, nor was geometrical or astronomical reasoning prepared for by any formal search after the final properties of space or of the heavenly bodies. Reasoning—the reasoning that is responsible for the great theories of modern science — began with these ideas furnished by the almost random experiences of life.

Although true conclusions frequently result from reasoning upon such a basis, we know of many instances of error resulting from the lack of care with which this idea or that was adopted. Perhaps the main reason why men found it so difficult to convince themselves that the earth was round was because of their acceptance at its face value of a certain idea about round objects, which idea they had picked up during their daily experiences. They knew that loose objects on the underside of round objects fall off. A small chip laid upon the top of an apple will stay there, but a chip laid upon the bottom side of an apple will immediately fall off. So-called practical experience had not shown them that this idea had definite limitations, and for that reason the

acceptance, in fact the mere consideration, of any apparently contradictory ideas seemed the worst kind of foolishness.

What ideas we acquire from a given experience depend upon the attitude we take toward that experience. Most of us tend to put the best possible interpretations upon our own acts, and the ideas we have about ourselves and our own lives are, therefore, likely to be prejudiced, to say the least. A Democrat who looks over the record of a Republican office holder is likely to see and remember only the evidences of inefficiency. A Republican, on the other hand, is equally likely to see and remember only the signs of efficient service. The fact that most people are unaware of the prejudices that affect their interpretation of experience and the ideas they derive from it makes the prejudices especially liable to influence subsequent processes of reasoning.

First step in accurate reasoning is questioning of the sources of our ideas. — In order to secure sound and accurate thought, it is necessary continually to examine the origin of the ideas employed in thought. It is necessary to ask how careful and free from prejudice were the observations or experiences that gave rise to the notions in question. One source of inaccuracy is the tendency possessed by all of us to fill in details of vague and general observations. Travelers and explorers returning from far countries have remembered what they saw and also what they thought they saw. Only recently was the belief exploded that the gorilla is a naturally fierce and warlike beast. When once such an idea gets into people's minds, it is very difficult to correct it. Each traveler who observed gorillas in their native haunts looked for signs of ferocity, and probably the most trivial and innocent acts of these apes were given a sinister meaning. When it turns out that ideas have been acquired in a manner that may easily have affected their reliability, such influences have to

be allowed for. Of course, we all recognize this to some degree. We discount the ideas that a chronic braggart furnishes about himself. Only an occasional and well-trained thinker, however, has the intellectual integrity to question the reliability of his own ideas, especially if they are ideas about matters of a somewhat personal character.

Science seeks to provide for the collection of accurate information. — Such sciences as geology, physiology, psychology, and the like are too often thought of as mere accumulations of information about the earth, the body, and the mind. In reality they are a good deal more than that. A scientist is as much or more interested in gathering new facts upon which to base his future reasoning as he is in harboring the facts that have already been gathered. Furthermore, he sets out after those facts in a business-like manner. He does not content himself with whatever facts happen to come his way. He makes active explorations into the realm of the unknown.

But the scientist, if he be a good one, knows that false facts are worse than no facts at all. For that reason he explores and collects with caution. Being out after facts, he has a great fear of burdening himself with fancies. He is on his guard against those things that tend to be mistaken for what they are not. He must, therefore, be critical in his observations. Before recording his impressions of events he needs to ask himself again and again, "Is this thing really what it seems to be?" A colleague told me a story about a recent great medical discovery which illustrated the ideal scientific way of collecting information. Two young men were carrying out an experiment in the physiological laboratory. One day they brought to their professor some results which seemed to indicate how a certain grave disease could be greatly benefited, if not cured. The professor was

familiar with their methods and had confidence that they had not committed any important error of observation. Still, he felt that he must be critical even of his own judgment. He pointed out that in their experiment they had studied only one dog. Now they must bring in several more dogs and go through the experiment step by step with each of these new animals. If, in every case, they were able to confirm their first findings, then, and then only, would he accept their findings as facts.

The critical attitude taken by the scientist in his observation of events is often spoken of as the *disinterested* attitude. This does not for a moment imply that the man of science is uninterested in what he observes, but merely that he has tried to free his observations from such personal preferences and desires as might influence him in a manner inimical to his own accuracy. There is very much more honor to be gained from discovering a new fact than from discovering one that is already known. Therefore, when an observer comes to something that he thinks is new, he must safeguard himself against his own preference. He would prefer it to be something hitherto unknown, but, understanding that he has this preference, he must take particular pains to make sure of his observation and free his findings from fictitious characteristics which his own desires are likely to attribute to them.

Not only facts, but complete facts, are required for sound reasoning. — Reasoning may turn out to be false, not because the facts upon which it is based are false in themselves, but because certain other indispensable facts were not considered. The scientist, seeking information as a basis for sound reasoning, has to make it his aim, not only to discover facts, but to discover and make available for thought every fact that is at all accessible and relevant.

One of the ways in which our personal desires and prejudices tend to weaken our thinking is by making us fail to observe facts of quite evident importance.

As a small boy I had, like most small boys, great ambitions to be a successful baseball pitcher. By dint of strenuous practice I had acquired the ability to throw a ball with a perceptible curve, but that curve was far from what I should have liked. It was neither large nor sudden-breaking. But one day I came into an earthly paradise. While engaged in practice pitching to a companion, I suddenly developed a curved ball of truly startling nature. My catcher could hardly follow it well enough to catch it, and plainly no batter would be able to do damage to such a ball as that. Now, here were the important facts, so far as I was concerned. I had discovered that by an extra twist of the wrist a baseball could be curved in almost unbelievable fashion, and I had discovered the nature of that twist. It is not unlikely that I *was* giving my wrist an extra twist that day, and it is certain that the ball was flying through the air most freakishly. As they stood, these facts were not erroneous, but they nevertheless led me to the erroneous conclusion that I had suddenly taken a great step forward in pitching skill. And the reason why my interpretation of these facts proved erroneous was that I had failed to pay attention to another fact, namely that the cover of the ball was so ripped as to allow a little flap of it to hang loose. I remember to this day that I was dimly conscious that that flapping cover might have something to do with the curve I had achieved, but I refused to pay serious or prolonged attention to the fact, for the simple reason that I did not want to believe it. Young boys are not the only ones who neglect to add certain facts to their collections, because they do not want these facts to be true. Only a great and un-

selfish love for the truth can produce a scientific frame of mind that looks desirable and undesirable facts equally in the face and, in the best sense of that saying, calls a spade a spade.

Scientific experiments aid in gathering information. — The conditions under which events occur in everyday life are exceedingly complex. If we start to record all of the facts which may be relevant to a given type of event, we are likely to find ourselves swamped by the task. Forgetting is an affair that is occurring day in and day out. There is no difficulty in observing it and the facts connected with it. The difficulty lies, not in collecting information about forgetting, but in collecting important and accurate information. About all that psychologists have been able to learn from casual observations of forgetting is the fact that it occurs, that some people forget more rapidly than others, and that some materials are more rapidly forgotten than others. The conditions under which forgetting normally occurs are too complex to reveal the important details of the process.

When complexities are many, as they are in the usual manifestations of forgetting, the scientific seeker after information may fall back upon one of the greatest tools of modern science, namely the experiment. The merits of the experiment are these, that it permits the scientist to observe facts in a little, artificial world over which he has as nearly as possible complete control.

Forgetting is observed in everyday life and in experiment. — If one wished to observe the rate of forgetting under the conditions of everyday life, think what a time of it he would have! He would come across an individual here who in three days had forgotten ten out of thirty lines of *Paradise Lost.* He would find an individual there who in a week had forgotten one out of forty lines of *The Ride of Paul Revere.*

But what would be the value of such facts and what would be their meaning? The observer would hardly dare record that he had observed the amount of forgetting after three days and again after a week and that it was greater in the first case. There are so many things he would not know about these facts that he could not take seriously that which he did know. If anything important were to be made of these two observations, it would be essential to know, among many other facts, the relative ability of the subjects whose forgetting was observed, the relative difficulty and meaningfulness of the material forgotten, the amount of time each had spent in the original memorizing, the amount of thought each had given to his poem since memorizing it. With sufficient effort, some of these facts might be determined, but probably the majority of them never could be.

Now, we may contrast the complexity of forgetting under the conditions of everyday life with the relative simplicity of the process when it is held under experimental control. In the chapter on memory we gave some tables showing in percentage terms the amount of forgetting that took place after certain definite periods of time. These data were obtained, not from observations of everyday life, but from experimental observations. The amount of time spent in memorizing was controlled; the subjects were such as could be trusted not to rehearse what they had studied except when asked to do so by the experimenter; the different units of material memorized were of the same general kind and of approximately equal difficulty; and in many other ways conditions were so simplified and controlled that the observer could be sure that he was observing real forgetting. When forgetting is observed under the conditions of everyday life, one does not know what facts are facts belonging to the phenomenon of forgetting and what belong to some-

thing else, such as the difference in memorizing ability of two subjects or the difference in the time devoted by them to study.

Experimental observations on the origin of life. — "The natural scientist has always recognized," we are told in *Reflective Thinking*, "that in most instances organisms are propagated by parents similar to the offspring. Another mode of generation, however, was formerly widely believed in. 'Heterogenesis,' the creation of a living organism out of inorganic matter, was generally accepted as another method. Animals as high in the scale of life as the frog were thought of as being in some cases the product of spontaneous generation. Eels were said to have come into being suddenly from the slimy ooze of the river Nile, and caterpillars and many insects were supposed to be the spontaneous product of the leaves on which they fed. A formula for creating mice was even suggested; and it was shown that they could be procured by putting grains of wheat with some dirty linen in a receptacle, whereupon the mice would presently appear."[1] Some people still believe that snakes grow from horse-hairs. It is evident that such erroneous ideas arise out of the complex conditions under which the origin of life is ordinarily observed.

It was especially difficult to make accurate observations of the conditions under which tiny, miscroscopic organisms get into water which had previously been sterile, and it seemed natural to record the fact that they did not come from anywhere, that they were just generated there. But by observing the facts in the simplified setting of an experiment, Pasteur was able to get at the true state of affairs. We shall read his own description of his experiment.

[1] *An Introduction to Reflective Thinking*, by Columbia Associates in Philosophy, p. 66 (Houghton Mifflin Company).

I place a portion of the infusion into a flask with a long neck . . . Suppose I boil the liquid and leave it to cool. After a few days mouldiness or animalculæ will develop in the liquid. By boiling I destroyed any germs in the liquid or against the glass; but that infusion being again in contact with air, it becomes altered as all infusions do. Now suppose I repeat this experiment, but that before boiling the liquid I draw the neck of the flask into a point, leaving, however, its extremity open . . . Now the liquid of this second flask will remain pure . . . What difference is there between these two vases? . . . The only difference between them is this: In the first case the dusts suspended in air and their germs can fall into the neck of the flask and come into contact with liquid, where they find appropriate food and develop. Thence microscopic beings. In the second flask, on the contrary, it is impossible, or at least extremely difficult, unless the air is violently shaken, that dusts suspended in air should enter the vase. They fall on its curved neck.[1]

Some facts have to be observed in actual life. — When he conducts an experiment, the scientist sets up well-controlled conditions and then carefully observes what happens. This is true whether he is investigating forgetting, the appearance of living organisms in water, or any other natural event. But observation of this sort has definite limitations. At any one time an investigator can bring under his control only a relatively few of the factors that may be important for a proper understanding of the world in which he lives. It is therefore necessary for him to gather information from the actual world as well as from the little artificial world which he is able to observe in his experiments.

Men have long been interested in the effects which indulgence in alcohol has upon human efficiency. It has been possible to conduct experiments that show what are some of these effects. The subjects of these experiments have

[1] Quoted from Pasteur, in *Reflective Thinking*, p. 71.

been given doses of alcohol of various sizes and in various dilutions and have then been made to perform at some test where the efficiency of their performance could be measured. Such experiments have shown that even small amounts of alcohol cause a reduction in efficiency. Still, it is dangerous to reason about life in general merely on the basis of such results. In real life we are interested, not only in such immediate effects of alcohol as can be observed within the limits of a scientific experiment, but also, and perhaps to a greater extent, in the long-run effects of this drug. We want to know how alcohol acts upon the offspring of those who indulge in it. For this reason experiments have been conducted which test the effects of alcohol upon several generations of white rats. But white rats, after all, are not human beings, and we cannot reason without qualification from facts observed about rats to what we may expect in human life. Now, obviously, it is hardly possible to conduct experiments on a number of generations of human beings. It might easily be possible, however, to collect facts about the health and achievement of sons and grandsons of alcoholics and such facts would usefully supplement what we have already been able to gather from experiment.

In many fields of knowledge the experiment must remain a method of very limited usefulness. Our knowledge of the heavenly bodies, their composition, and their movements must be gained from observing them without the aid of experimental control. We can of course devise telescopes and other instruments to make observation more accurate, but we cannot exert any such control as was present in Pasteur's experiment with the microscopic organisms and the water. Our knowledge of the history of the earth's crust can come only from observing the actual layers of rock as they appear, for instance, in the familiar outcroppings at the hill

sides. Our knowledge of the development of human life from the crude days of savagery to the present can be gathered only from the historical records that have come down to us. We cannot reproduce in an experiment the manifold history of humanity. We cannot reproduce in an experiment even the simpler phases of that history.

And so it is that the scientist must collect his facts however he can. Where he can conduct an experiment, he does so. Where phenomena are not susceptible to experimentation, he must observe their natural and uncontrolled occurrence.

The repetition of observation is an aid toward accuracy. — It is especially true in actual life that events seldom occur twice in exactly the same way. This is one reason why a fact determined from a single observation is likely to be of very limited significance. No intelligent man would say that pipe-smoking insures a long life merely because he knew a man of eighty-nine years who had smoked a pipe since early boyhood. Furthermore, no intelligent man would say that pipe-smoking causes early death because he knew a pipe smoker who died young. Before coming to a conclusion as to the relationship between pipe-smoking and length of life, it would be wise to collect information about many smokers and also about many non-smokers. Only from such information could one come to a valid conclusion as to what is true, not in some one particular case, but in the long run.

The natural limitations of our own powers of observation as well as the variability of the events observed make it desirable for us to look, not once, but many times. Suppose that I wish to know the exact height of a certain man. No matter how carefully I go about measuring him, I am likely to make an error. Perhaps I take him to be slightly

taller, perhaps slightly shorter, than he really is. But if I measure him several times and then average together the results of those different observations, the overestimations and the underestimations will often cancel each other to a considerable extent, and what I have left will be nearer the truth than a single measurement would have been. It should be borne in mind, though, that this process of repeated observation is not an infallible method of attaining accuracy. It is only when one's errors tend to fall in one direction as often as in another that an averaging of observations will give facts of a more accurate sort.

Accuracy is aided by random sampling. — We have already alluded to the fact that what one observes is likely to depend upon what one wishes to observe. Only when one is on his guard against his own prejudices is he able to accept each truth at its proper value. There are those who believe that much can be concluded about a person's character and ability from the color of his hair. They have realized, however, that their doctrine would not be generally believed without a collection of supporting facts. And so they have gone after these facts. The result is a list of names from history of blonds of similar characteristics and another list of brunettes of similar characteristics. The blonds were men of daring, of impatience, of vigor; they were leaders of men. The brunettes were more quiet, patient, studious, and solitary. But is the fact that one can get together a list of similar blonds and another list of similar brunettes adequate ground for concluding that character can be judged on the basis of hair-color? No, it is not; and the reason why it is not is that there is no guarantee that the blonds and brunettes were chosen impartially and at random. It is perfectly true that there are numerous blonds of similar personal traits and capacities and also numerous brunettes of similar

personal traits and capacities. Wherefore it is no great trick, if one but looks about and chooses his cases carefully, to collect such groups as we have mentioned. But we must not forget that there may be as many blonds having the alleged brunette traits as brunettes, and as many brunettes having alleged blond traits as blonds. If this is true, the conclusion that character can be judged from hair-color is groundless. Obviously the correct method for testing this possibility is that of picking blonds and brunettes, not according to how well they fit into the purposes of our argument, but simply at random. As a matter of fact, such a procedure has already been employed by competent investigators, and the result has shown that the alleged blond traits are possessed equally by blonds and brunettes, and so also with the alleged brunette traits.

This method of random sampling has broader uses than that of overcoming the preconceptions and prejudices of the observer. If I wanted to know the height and weight of school children in Chicago, I might measure and weigh one thousand children from one community, or I might pick the thousand children at random from different parts of the city. If my purpose were that of collecting information which would give grounds for reasoning about Chicago children in general, the second method would be preferable. The first might result in my observing a group which was on the whole better nourished and cared for or worse nourished and cared for than most children of Chicago.

The practical rule is this: We must take close account of those factors that determine what we observe, and see that we are not influenced by them into making a false interpretation of the facts.

Scientific attitudes and methods can be applied in everyday life. — Science makes a business of collecting facts,

and it is in science that we find the application of precautions against error most earnestly applied. The scientific attitudes of disinterestedness, care, and patience, and the methods of experiment and random or unprejudiced sampling can, nevertheless, be applied far beyond the boundaries of those formal disciplines, physics, chemistry, biology, psychology, and the like, which are the recognized branches of science. "Now this is the peculiarity of scientific method," says Karl Pearson, one of the great scientific figures of our day, "that when once it has become a habit of mind, that mind converts *all* facts whatsoever into science. The field of science is unlimited; its material is endless, every group of natural phenomena, every phase of social life, every stage of past or present development is material for science. *The unity of all science consists alone in its method, not in its material.*"[1]

D. How Valid Reasoning Goes On

Sound reasoning is a proper manipulation of ideas. — A man who is confronted with the necessity of investing a sum of money may possess sufficient knowledge to choose a trustworthy security, but the possession of such knowledge is not a certain guarantee that he will make a wise choice. One who, because of actual lack of knowledge, cannot entertain in his reasoning ideas of the pros and cons of this and that investment is clearly at a disadvantage. The point that we have emphasized in the third part of this chapter is that knowledge is the foundation upon which reason rests. But, granted that a man has wide and reliable knowledge, there is something else to be reckoned with. How well does he employ that knowledge? How

[1] *The Grammar of Science* (3d ed.), Part I, p. 12 (Adam and Charles Black, London).

well does he evaluate the possibilities and choose that idea which best deserves to be acted upon?

Clear conception of problem a necessity. — Before one has a right to hope for a successful application of his knowledge to the solution of a problem, it is necessary that he have a clear conception of the nature of the problem he is trying to solve. If a political philosopher were to ask himself how all men might be made equal, his chances of finding anything like a satisfactory answer would depend upon his understanding of the question itself. If he meant by "making all men equal" simply removing all differences in the circumstances under which life is lived, all differences in health, wealth, and happiness, he would be facing a problem which he himself would recognize as futile. If, on the other hand, he stopped to examine his problem and to limit it and to define it, he might formulate a question possible to answer with some degree of truth. If he meant by "making all men equal" giving everyone a fair opportunity to become self-supporting and reasonably independent, then he might go about his thinking with a hope of some success.

One of the best illustrations of the need for getting a clear conception of the problem to be solved is apparent when we turn our attention to the progress of the average argument. The participants try to reason with each other without first making sure that they are talking about the same thing. One of them is convinced that his arguments are the right ones, and the other, whose arguments seem to point in the opposite direction, is just as sure that his are right. Now, as a matter of fact, the chances are that both are equally in the right, but that they are arguing about different things. Under such circumstances the more ideas each puts forward, the surer the other feels that these ideas

are irrelevant to the question at issue. If they would only stop, go back to the question itself, and reach an agreement as to what they are arguing about, as to exactly what they are, after all, seeking to decide, they would often fall into complete agreement with each other.

The disinterested attitude is necessary in evaluating ideas. — We have previously shown how essential it is for one who is collecting facts about any subject to free himself from personal desires and prejudices which might make him blind to those things that he does not care to know. It is equally important that this attitude of disinterestedness be maintained in the actual process of reasoning. When the problem which one is facing is of such a nature that it deserves reasoning about, when it is a problem for which one has no ready-formed solution, a period of suspended judgment is desirable. During such a period the reasoner tries to think of all of the possibilities involved without allowing himself to be too much swayed by the temporary attractiveness of any of the many ideas that occur to him. We have all heard it said by some person who was reasoning out a conclusion in regard to an important question that he would like to sleep on the matter. By this it is often meant that, though a certain conclusion seems attractive enough at the time, the reasoner prefers to give his emotions time to cool, so that it will be more possible to evaluate that conclusion in the light of long-run consequences.

In the reasoning, itself, as well as in collecting information, a disinterested attitude does not mean an actual lack of interest in the problem. Rather it means a checking of desires and prejudices of a more temporary character in order that a conclusion may be reached whose long-run consequences have been taken into account. Consider the case of a young man seeking to determine what occu-

pation will give him the most satisfactory life. There are many items to be thought about. In order to simplify matters somewhat, let us confine ourselves to the financial side of the question, although there are in reality many other factors to be taken into equal, or greater, account in the selection of an occupation. Let us say that one of two occupations under consideration offers a relatively high salary at the beginning, and the other, while offering scarcely enough to live on for the first several years, presents the possibility in the course of time of giving great financial rewards. If the first occupation be selected, our young man will almost immediately find himself in comfortable circumstances. He will be able to dress well, buy good seats at the theater, and in other ways satisfy desires that are very immediate. If the second occupation be selected, there will be months, perhaps years, of sacrifice ahead. He will have to deprive himself of present luxuries for the sake of prospects that seem hazy and remote. Under such circumstances only cool and unhurried deliberation is likely to lead to a wise choice.

Disinterestedness is sometimes difficult to attain.—When one is reasoning about some abstract mathematical proposition an attitude of suspended judgment is relatively easy to maintain. Of course, even in such a case one has to guard against jumping to the first conclusion that occurs to him. One has also to guard against such things as the natural impatience to get the problem solved as soon as possible. But one is not likely to have strongly fixed desires and prejudices in the field of mathematics. When, on the other hand, one is reasoning, or attempting to reason, about problems which touch one's personal life, there is a stronger impulsiveness and impatience to guard against. The ideas that are entertained are likely to be of a strong emotional

character, and the sheer logic of the situation stands a strong chance of being neglected. After a person has once voiced an opinion upon a certain subject, it is not easy for him to decide simply on the basis of logic whether his opinion is right or wrong. If it turns out that he is in the wrong a reflection is cast upon the caliber of his intelligence. If it turns out that he is right, his intelligence is vindicated. Under such circumstances it is very difficult for a thinker to attach the same value to arguments against his opinion as to arguments in favor of it. There is a marked contrast between a situation of this type and one where a person is evaluating ideas none of which has a bearing upon his own ability or his own character.

Reasoning which is brought to bear upon social questions is especially likely to suffer from deep-seated hopes and desires that tend to prevent disinterestedness. A man who enjoys the advantages of wealth and power is generally unable to see the advantages of a type of social and economic life which might make it more difficult for him to gain further wealth and power or which might even make it difficult for him to hold what he already has. The less fortunate individual, on the other hand, is frequently unable to see that wealth and power may be necessary to secure for society the full efforts of those of great ability. We, ourselves, as we consider the psychology of the parties to such a controversy, are not attempting to decide whether or not it is desirable to allow very able individuals to acquire large amounts of wealth and power. We are merely showing how hard it is for the man with wealth to see the possible advantages of a system under which he would not possess this reward and how hard it is for the less fortunate one to see that society as a whole may be better off with the total wealth unequally divided.

Other difficulties in the way of sound thinking. — Besides our general impulsiveness and our tendency to confuse truth and desire, there are many other factors which make the achievement of sound thinking very difficult. Our minds are likely to become enslaved to authority and tradition. During the Middle Ages Aristotle's opinions about natural phenomena were accepted literally and completely. To question one of them was to be guilty of a sort of crime. When the authority of one man's teachings becomes raised to such a point, sound reasoning upon the subject of his teachings becomes confronted with a definite barrier. Similarly a tradition, such as that about the flatness of the earth, or even that about the fundamental inferiority of women, if believed long enough acquires a power which somehow makes it seem true in the face of almost any sort of logical evidence to the contrary.

Novelty, as well as antiquity and an authoritative source, may increase without logical warrant the seeming truth of ideas. When the modern democratic governments were first taking shape, the idea of equal rights for all men was relatively novel to most people of the times. This novelty gave the idea of equal rights a tremendous force. The idea was accepted as something worth realization. That was only a proper evaluation. The novelty carried the idea forward in popular thought, however, until it was considered not only a worthy idea, but one whose realization would cure most of the troubles of mankind. Now that we have lived with this conception for many years and are no longer unduly influenced by its novelty, we still consider it a good one, but we no longer consider that its realization would be a cure-all.

High-sounding statements are often accepted as true just because they sound true. If one can but succeed in formu-

lating an idea into words, he is likely to think that, because his idea is cleverly stated, its truth has in some way been established. "Up to a comparatively recent date," according to Professor James, "such distinctions as those between what has been verified and what is only conjectured, between the impersonal and the personal aspects of existence, were hardly suspected or conceived. Whatever you imagined in a lively manner, whatever you thought fit to be true, you affirmed confidently; and whatever you affirmed your comrades believed . . . One need only recall the dramatic treatment even of mechanical questions by Aristotle, as, for example, his explanation of the power of the lever to make a small weight raise a larger one. This is due according to Aristotle, to the generally miraculous character of the circle and of all circular movement. The circle is both convex and concave; it is made by a fixed point and a moving line, which contradict each other; and whatever moves in a circle moves in opposite directions. Nevertheless, movement in a circle is the most 'natural' movement; and the long arm of the lever, moving, as it does, in the larger circle, has the greater amount of this natural motion, and consequently requires the lesser force."[1] All of this is very fine-sounding talk and, because of its fine sound, Aristotle himself doubtless took it to be true. Yet, if we stop to examine the meaning of these statements, it is easy to see that they are mostly stuff and nonsense.

In reasoning we frequently seek to work out a solution for a present problem by recalling other similar situations and by applying to this present case some rule that has been found to hold for the earlier situations. One of the most prevalent errors of reasoning arises out of the fact that a present

[1] *The Varieties of Religious Experience*, pp. 495 ff (Longmans, Green and Company).

situation is likely to be interpreted in terms of some past experience which is related to the present only in a superficial and unimportant manner. This will be clearer if we consider an illustration. Herodotus explained the fact that the sun is seen in a more southern part of the sky in winter by saying that the cold in the north drives the sun to the south. When men and birds move south regularly, it is because of the cold. Here we have the sun moving to the south; what more natural than to assume that it also is moving south to escape the cold?

In the history of human thought man has been especially prone to interpret all natural happenings in human terms. This tendency, which has by no means entirely disappeared, is called *anthropomorphism*. The ancients endowed sun, moon, stars, the sea, the winds, the seasons, with personalities, and they explained their actions in personal terms. A violent storm was thought to express the rage of one of the gods, and a warm, gentle wind was thought to be the expression of a gentle temper on the part of another god. Man knew that his own violence was caused by rage within his breast. What more natural than to explain the storm in terms of some great personal rage, such as a god would presumably manifest? In the same way other superficial similarities between his own life and that of the larger natural world have led man to interpret events of that larger world in terms of the uses and desires which are important for human life. We now look upon the sun as a fundamental factor in the very existence of the earth. Life as we know it could not have appeared on a sunless world. Yet as late as the eighteenth century learned men discussed the sun as though it were chiefly to be thought of, not as a fundamental cause of there being any such things as living creatures, but rather as though it were to be thought

of as a mere convenient instrument which God placed in the sky for the sole purpose of making human life more bearable. Look at the following words of a German scholar, famous in his time:

> . . . The sun makes daylight, not only on our earth, but also on the other planets; and daylight is of the utmost utility to us; for by its means we can commodiously carry on those occupations which in the night-time would either be quite impossible, or at any rate impossible without our going to the expense of artificial light. The beasts of the field can find food by day which they would not be able to find at night . . . If anyone would rightly impress on his mind the great advantages which he derives from the sun, let him imagine himself living through only one month, and see how it would be with all his undertakings, if it were not day but night. He would then be sufficiently convinced out of his own experience, especially if he had much work to carry on in the street or in the fields . . . From the sun we learn to recognize when it is midday, and by knowing this point of time exactly, we can set our clocks right, on which account astronomy owes much to the sun.[1]

Reasoning may be mainly inductive or mainly deductive. — Reasoning is said to be inductive when the consideration of a number of specific facts leads to the establishment of a general principle. Gravitation is a general principle established from observation of the behavior of unsupported objects. The principle of vaccination has been established on the basis of our knowledge of the incidence of smallpox among the vaccinated and the unvaccinated. The typical warmth of summer and coldness of winter are principles of weather change which have been established as the result of our experience with hundreds of individual seasons. These

[1] Quoted by James, *Varieties of Religious Experience*, p. 492 (Longmans, Green and Company).

principles are conclusions reached through processes of inductive reasoning.

Deductive reasoning, on the other hand, is that which leads to an interpretation of the specific or individual fact in terms of some general principle. Robins leave the Great Lakes region in the fall. From this principle I may be sure that the robin which now, in May, sings outside my window, will not be in this neighborhood on next Thanksgiving Day. It is a general principle that things equal to the same thing are equal to each other. If this principle is true, it follows without further proof that, since $6 + 6 = 12$ and $8 + 4 = 12$, $6 + 6 = 8 + 4$.

There is a certain usefulness in distinguishing between these two directions which reasoning may take — from the particular to the general and from the general to the particular. It is of perhaps equal importance, however, to realize that reasoning is never purely inductive or purely deductive. When one arrives at a general principle from a consideration of particular facts, he is almost sure to have in mind, if only vaguely, the general principle, even while he examines each particular fact. The principle is usually arrived at relatively early, and the consideration of particular facts tends merely to modify or confirm it. Similarly there is an element of induction in all deduction. Each time a principle is employed in the interpretation of a particular fact, the principle as well as the fact appears in a new light as a result of the interpretation.

E. The Results of Reasoning

Conclusion reached through reasoning may be quantitative or qualitative. — Things equal to the same thing are equal to each other; $(a + b)^2 = a^2 + 2\,ab + b^2$; the square of the hypothenuse of a right-angled triangle is equal to the

sum of the squares of the other two sides; the intensity of a sound is inversely proportional to the square of its distance; these are quantitative conclusions. Conclusions capable of quantitative expression are particularly typical of science, although not all science can express its conclusions quantitatively with the same facility. The sciences of chemistry and physics have reduced many of their important laws to mathematical terms. Such quantification has been much less possible in the sciences of geology and physiology. In practical life quantitative statements of things are especially important in the mechanical arts and surveying. They are also important in finance. Think of bookkeeping without the use of figures and accounts indicating the exact amounts of money spent here and collected there! Think of trying to express the outcome of a year's business without stating one's conclusion in quantitative, numerical terms!

There are many ideas, facts, conclusions, which do not lend themselves to quantitative statement. "Kindliness is a worthy quality"; "good health tends to make one happy"; "dishonest officials are a menace to good government"; these are qualitative conclusions. Exact figures can be given in regard to none of these, and none can be embodied to any avail in an algebraic or geometric form.

It is a habit of the scientifically minded to seek to get all the conclusions of thought into quantitative form. This is not because qualitative conclusions lack validity, but because a quantitative conclusion almost always possesses more detail; it expresses the truth more completely. One day the instructor in a class in physiography, a man of pronounced scientific ideals, asked a young woman in the class about the height of a certain mountain. She replied that the mountain was "quite a high one." It is not necessary to repeat the scolding in which the instructor indulged upon hearing her

answer. But the important point of it was this. Her answer was as correct as any answer could well be. Probably no living man would have questioned the proposition that this mountain is a high one. On the other hand, such a conclusion about this mountain was scarcely of a scientific order. The ordinary man may find it quite sufficient to know that a mountain is very high, while a scientist may find it important to know whether the mountain is 14,549 or 14,550 feet in height. It is enough for most purposes to know that the sun rises earlier in summer than in winter, but for scientific purposes it is important to know at just what rate the moment of sunrise varies throughout the year. The exact, quantitative conclusion which science has formulated in regard to the time of sunrise is no more true than the conclusion that the sun rises earlier in summer than in winter. But it is very much more complete. It contains within it many details which are not present in the qualitative formulation.

Conclusions vary in certainty. — If a physician concludes that a man with an opened artery will bleed to death unless the opening in the blood vessel be in some way closed, that conclusion is a relatively certain one. He does not have to say that the majority of men would bleed to death under such circumstances. He can say instead that this particular man is sure to die if his artery remain open. Similarly, if I throw a stone into the air, I may conclude with certainty from past experience that that stone will fall to earth again. I do not have to say that the chances favor its falling or that most of the stones so thrown will fall. I can conclude from my knowledge that this particular stone most certainly will fall.

As a result of our reasoning, we often draw conclusions that state what is probable rather than what is certain.

When the physician of a life insurance company examines an applicant for a policy, he comes to a conclusion as to the likelihood of the applicant living for, let us say, twenty years longer. His conclusion may be that the chances are ten to one that this individual will live for at least twenty years longer. This conclusion has an entirely different degree of certainty from that pertaining to the man with the opened artery and that pertaining to the stone thrown into the air. There is practically no chance that events will not confirm the latter conclusions. The conclusion which the insurance company draws about its client, on the other hand, has a substantial chance in the individual case of not being confirmed. Indeed, in stating that the man's chances of living twenty years longer are ten to one, the company is recognizing a degree of uncertainty about its conclusion.

It would be impossible to enumerate all of the fields in which we have to be content with probable rather than with relatively certain conclusions. The next man who passes my house will probably be between 64 and 72 inches in height, but it is not at all unlikely that he will be shorter or taller than that. It is probable that the thermometer will register zero Fahrenheit in Chicago some time next winter, but there is an appreciable chance that it will not.

There is a condition, and this it is very important to note, under which probabilities become practical certainties. If the success of each life insurance company depended upon its prediction of the length of life of some one individual now of a certain age, the business would be a precarious one. But life insurance companies insure many lives, and whereas the prediction about one life will almost surely be erroneous, the prediction about many may reach a high degree of accuracy. The vast majority of apparently healthy men of twenty live to be forty. Not only that, but it is possible to predict

accurately how many out of a large number of such men will actually live to be forty. The next man who passes my house may not be between 64 and 72 inches in height, but the number out of the next five hundred passing my house who will fall within that range of heights could be predicted with great accuracy. The thermometer at Chicago may not go below zero next winter, but it would be possible by studying the records of the weather bureau to say with a good deal of certainty during how many winters out of the next one hundred the thermometer will fall that low. Perhaps a better illustration is yielded by what happens when we toss a coin. If the coin is tossed once, our chance of concluding correctly from past experience whether it will fall heads or tails is 50 per cent. But if the coin is tossed a thousand times, we can come very close to predicting how many times it will fall heads and how many times it will fall tails.

Conclusions reached through reasoning prepare for action or for further thinking. — Let us return for a moment to the case of the man who is selecting from the many possible routes that one which will get him to a distant part of the city most quickly and conveniently. As soon as this man reaches a conclusion he will act upon it. But in reasoning, as in ideational and perceptual activity in general, such overt action as that of actually getting up and going somewhere is by no means a necessary consequence. A man engaged in a complicated process of thought may reach and adopt dozens of conclusions without showing any tendency to put them into action. This is because one may reach, besides conclusions about how to act, conclusions about how to think. Consider that great biological conclusion, the theory of evolution, which holds that present complex forms of life have developed out of other earlier simpler forms. Now, such a theory may have some

influence upon actual, overt action, but certainly its main influence is upon our ways of thinking about things. This theory was first developed in regard to the bodily structure of organisms. Soon after its adoption, however, the influence of the evolution conclusion became apparent, especially in the manner in which mind was thought about. The conclusion that the bodily structure of organisms develops by a process of evolution led to an application of the doctrine of evolution to the explanation of mental life, and thinkers decided that mind as well as body is produced by evolution.

Summary of the Chapter

1. In reasoning, problems can be solved through the employment of ideas. The advantages of this procedure are that it saves the energy required for the actual trying out of alternative actions; that it prevents the carrying out of erroneous actions; and that it enables us to prepare to meet problems before they actually arise. When we are confronted by strange and complicated problems, however, reasoning must often be mixed with action of a completer sort.

2. Not all forms of ideation are reasoning. A distinguishing mark of reasoning lies in the fact that during this process there is a direct facing of the problem to be solved.

3. The mere fact that one reasons is not, in itself, a guarantee of his intelligence and efficiency. It is the accuracy rather than the sheer amount of thinking that counts. In general, reasoning is most likely to add to one's efficiency when the problem is most complicated, and most likely to prove a distraction when the problem is simplest.

4. Information is the basis of reasoning. The accurate reasoner must, therefore, know something of the source of

the information which he employs in his thinking. Information picked up casually in everyday life is liable to be untrustworthy, owing to its incompleteness and to the prejudices which affect it. Scientists adopt a number of devices to secure information which is reliable and complete. Among these are the disinterested attitude of observation, the experiment, the repeated observation, and random sampling.

5. Another requisite for sound reasoning is a clear conception of the problem one wishes to solve.

6. In the actual manipulation of ideas, which constitutes reasoning, it is necessary to adopt the disinterested attitude and to avoid the undue influence of customary authority, of mere novelty, of high-sounding statements, of superficial similarities between situations, and of anthropomorphisms.

7. The reasoning process may proceed mainly from the particular to the general, or mainly from the general to the particular. In either case, though, there are elements of both particularity and generality throughout the process.

8. The conclusions which we reach from reasoning may be quantitative or qualitative, and they may express what is almost certainly true or only what is probably true. But even the conclusion which expresses a mere probability may be quite exact, if it is considered in its application to a large number of cases.

9. Through reasoning we prepare for action and also for further thinking.

PROBLEMS

1. Give an instance in which you saved energy by reasoning, another in which you avoided error by reasoning, and still another in which you prepared by reasoning for the appearance of a future problem.

2. Give an instance in which you found it necessary to supplement your reasoning with action.

3. How many times have you engaged in reasoning during the past twenty-four hours? What was your problem in each case?

4. What do you think of the statement that the well-trained man is spared much reasoning that the poorly trained man must indulge in?

5. If sound reasoning depends upon the possession of reliable information, what is the relationship between reasoning and memory?

6. Write down a list of ten items of information which you have acquired casually in everyday life. How many of these would you trust if you had to use them in reasoning?

7. There is a common belief that slow workers are more accurate than fast workers. Are you willing to accept this belief or would you like to see it subjected to experiment? Why?

8. Why would it be impossible to determine by experiment how there came to be so many great writers in Elizabethan England?

9. When, in the collection of facts, is it desirable to make many observations, and when may a very few be relied upon?

10. Does random sampling mean a haphazard collecting of facts? Justify your answer.

11. Does the following question express a clearly conceived problem: How much education should a person have?

12. Cite three problems which could easily be faced in an impersonal or disinterested attitude, and three others which tend to involve our prejudices to a greater degree.

13. Give an opinion which is commonly held largely on account of its antiquity; another held largely because of its novelty; a third held largely because it sounds well.

14. Describe a process of reasoning which is mainly inductive. One which is mainly deductive. Show the deductive elements in the inductive process and the inductive elements in the deductive process.

15. It is sometimes held that all conclusions are really quantitative, and that so-called qualitative conclusions are merely less accurate quantitative ones. What do you think about this?

16. When I toss a coin into the air and guess whether it will fall heads or tails, I shall guess incorrectly half the time. Does this mean that my knowledge of how coins fall is very inexact? Explain.

REFERENCES FOR FURTHER STUDY

Carr, *Psychology*, pp. 189–191; or *Readings in General Psychology*, Ch. XVI, Selection 4-A, p. 411 f.

Loveday and Green, *An Introduction to Psychology*, pp. 214–222; or *Readings*, Ch. XVI, Selection 4-B, p. 412 ff.

Dewey, *How We Think*, pp. 68–78; or *Readings*, Ch. XVI, Selection 4-C, p. 417 ff.

Binet, *The Psychology of Reasoning* (3d ed., tr. by Whyte), pp. 79–88; or *Readings*, Ch. XVI, Selection 7, p. 431 ff.

PART V

FEELING

CHAPTER XIII

FEELING

A. Feeling Compared with Cognition
B. The Make-up of Feelings and Emotions
C. The Origin and Development of Our Feelings
D. Feeling and Other Forms of Activity

Questions to Keep in Mind while Reading this Chapter

1. What are the distinctive features of feeling and emotion?
2. How can one control feeling and emotional habits?

A. Feeling Compared with Cognition

Knowing is concerned with external objects having well-defined characteristics. — Beginning with our seventh chapter, which dealt with perception and attention, and continuing through six chapters up to the present point, we have been treating of *knowing* rather than of *feeling*. Perhaps a better group name for perception and ideation and those special manifestations of ideation in imagination, memory, and reasoning is *cognition*.

Before attempting to distinguish between the knowing or cognitive activities and the different varieties of feeling, it will be well for us to summarize the general characteristics of cognition. In the first place, cognition is especially likely to deal with objects and events external to the person who is doing the knowing. While the actions of eye, optic nerve, brain, and even of muscles are essential conditions for the visual perception of an object, the object perceived is usually

external to the perceiver. And it is the object perceived with which the perceiver is concerned. A man who did not know he had a brain could perceive an object as efficiently as an expert student of anatomy. It is, of course, possible to perceive occurrences at the surface of the body and within the body, but the highest development of our intellectual or cognitive life is dependent upon the perception of external objects and events.

Ideation is another fundamental form of cognition. We have devoted one chapter to a consideration of the general nature of ideation, and other chapters to its appearance in memory, imagination, and reasoning. Ideation, like perception, is usually concerned with external objects and events. One may have many thoughts about what is going on, what may go on, or what has gone on within the confines of his own organism. Nevertheless our most highly developed remembering, imagining, and reasoning is mainly concerned with that which goes on around us rather than with that which goes on within us. It is as true in ideation as it is in perception, that bodily activity — the activity of sense-organs, muscles, and brain — are absolutely essential. But one's ideas may work just as well, may represent the truth just as accurately, without one being aware of what those bodily processes are.

We may summarize this first characteristic of cognition, then, by saying that cognition, while it may be concerned on occasion with the knower's own organism, is more typically concerned with what is going on outside of the knower.

A second fundamental characteristic of cognition is this: In knowing or cognizing an object or occurrence, one is aware of something which has a certain definiteness about it and certain attributes which one can readily get at. When one perceives a flame there is definiteness about the expe-

rience. Also there are within that experience definite attributes which can be certainly identified. The flame has color, shape, and motion. When one perceives a box he is aware, not only that the object before him is a box, but also that it is a square box. And the mere continuance of the perception will, as it were, bring out of this experience other definite attributes of the box, such as its woodenness, its size, its whiteness.

In ideation, too, our mental activity is concerned with something definite possessing a greater or less number of clear characteristics or attributes. The forms of our ideas may not be definite, but what they refer to *is* definite. In fact, we could scarcely be said to have an idea of an object unless we were clearly aware of at least some of its characteristics.

We have said this much about cognition: it has to do mainly, though not always, with the world outside the knower himself, and it brings into clear awareness certain definite characteristics of that which is perceived or thought about. Now for feeling!

Feeling is an internal affair. — States of feeling, such as the state of being pleased, or that of being displeased, are important, first of all, as being states or conditions of some individual. When I say that I like cool weather, I am not indicating a characteristic of weather so much as I am indicating a condition which is aroused *in me* by cool weather. When I say that I dislike pineapple, I do not by any means imply that the pineapple is intrinsically an unpleasant fruit, but merely that it sets up within me the state or condition called "disliking." Thus, while knowing, or cognition, is mainly concerned with objects and events external to the person who is doing the knowing, feeling is concerned with a condition of the person himself.

Feelings lack the definite characteristics of cognitions. — When I have a feeling, I am definitely aware of the fact that it is *I* who feels. I may also be aware of whether I feel pleased, tired, or calm, but the state of feeling does not lend itself to extensive analysis. When one perceives a flame, there are within that experience, as we have said, definite attributes such as color, shape, and motion, which one can readily get at. This is much less true of a state of feeling. Suppose that we speak to a friend whom we come upon while he is looking at a beautiful picture. If we ask him to tell us about the picture, he will be able to enumerate the objects and colorings of which it is composed. But if we ask him to explain to us just how he feels about the picture, his answer very likely will be much less specific and detailed. He may tell us that his feeling state is that of mild or intense enjoyment, but beyond that he is hardly likely to go. Scores of external qualities can be enumerated when one looks upon a great mountain, but the feeling of enjoyment, or perhaps of awe, which the sight of the mountain arouses within one cannot be described, save in the most general terms. States of feeling may be just as real and vivid experiences as cognitions, yet always they possess a certain vagueness.

Line between cognition and feeling is not sharp. — There are some human reactions or experiences which one scarcely knows whether to class as cognitions or feelings. This is true of hunger. Although hunger is an internal state, it sometimes has a definite quality and a definite location. In such cases one perceives his hunger rather than feels it. On the other hand, hunger may consist of a vague faintness that seems to pervade the body generally. Under such circumstances one really *feels* hungry. The situation is much the same in the case of nausea. Nausea

may be referred definitely to the region of the stomach, and it may be analyzable into specific muscular and organic sense qualities. On other occasions nausea may be a vague, all-over type of experience or, in other words, a feeling rather than a cognition.

B. The Make-up of Feelings and Emotions

Feelings depend upon the action of sense-organs. — In Chapter II we showed how all of our knowledge of what is going on around us and within us depends upon the stimulation of the sense-organs which are situated in various parts of the body. We showed also that those sense-organs can be divided into a number of different classes. One class, often referred to as the *exteroceptors*, keeps us in touch with what is going on outside of us, either at the surface of the body, as in the case of touch, or at a distance from us, as in the case of sight and hearing. Now it is upon these exteroceptors that most of our cognitive life depends. The other classes, often referred to as *proprioceptors* and *interoceptors*, keep us aware of our postures, our movements, and internal conditions. The experiences made possible by these sense-organs are very likely to be vague and not clearly localized. It is to such experiences, as we have already said, that the term *feeling* is applied. We must not forget, however, that proprioceptors and interoceptors are often central factors in activity that is more a matter of cognition than of feeling. In the chapter on ideas we showed that movements and postures — and these we become aware of through our proprioceptors — may serve as ideas, and ideas are cognitive activities. We have shown how the operation of the interoceptors in hunger might lead to an experience of such definiteness that we certainly should call it a cognition rather than a feeling.

Since it is impossible to draw a sharp line between feeling and cognition, these exceptions to the general rule that exteroceptors give rise to cognitions and that proprioceptors and interoceptors give rise to feelings need not cause any great amount of worry. The gist of what is worth remembering is this: Feelings refer directly to the states of the individual who experiences them. This being true, we should naturally expect to find the action of proprioceptors and interoceptors — those sense-organs which have to do with one's own movements and internal conditions — especially important factors in feeling. And that they unquestionably are.

Pure feeling does not occur in actual life. — The experiences of actual life are rarely, if ever, purely feelings. While one feels hungry, nauseated, tired, or glad, he is also perceiving, remembering, imagining, or reasoning. We distinguish between feeling and cognition, not because such states exist separately, but merely because this distinction gives us a clearer conception of all the phases of mental activity. We find it helpful to speak of the length, breadth, and thickness of a cube, but no one would suppose for a moment that length by itself, breadth by itself, or thickness by itself is capable of being experienced in a concrete way. While the art lover feels enjoyment as he looks at a remarkable painting, he is also perceiving that painting and he also may be thinking of what an understanding mind the painter must have had. But it is most important for a clear understanding of the art lover's state of mind that we distinguish between the perception of the picture and the ideas aroused by it, and that vague, pervading state of the spectator's organism which is the *feeling of enjoyment.*

A feeling state may be pleasant, or unpleasant. — We may for convenience group together those feeling states which are typically pleasant, whether or not we believe

that they have the same fundamental bodily processes for their basis. A few of these pleasant states are liking, well-being, cheerfulness, energeticness, relaxation, excitement when it is not too intense, self-confidence, and amusement. There are other feeling states which are typically unpleasant. Among them are disliking, malaise, depression, weakness, tiredness, restlessness, too intense excitement, self-consciousness or embarrassment, and boredom. We might also place in this second list hunger, thirst, nausea, and dizziness. The pleasant feeling states are characterized by the fact that the individual experiencing one of them is likely to try to continue that state. The individual experiencing an unpleasant feeling state, on the other hand, is likely to try to put an end to that state.

We have said that the feelings in our list of pleasant states are typically pleasant and that those in our list of unpleasant states are typically unpleasant. By this we have meant to imply that there are conditions under which some, if not all, of the typically pleasant states may become unpleasant. Excitement, as we have said, is pleasant when present in a mild form, and distinctly unpleasant when present in too intense a form. One may enjoy feeling energetic, but such a state, if too pronounced, really amounts to restlessness, and restlessness is quite likely to be unpleasant. Liking is ordinarily a pleasant experience, but if one is kept from expressing that liking in a natural manner, as by gaining possession of the object liked, the liking itself may become disagreeable.

We have meant also to imply that typically unpleasant states may, upon occasion, be actually enjoyable. Tiredness is usually, perhaps, thought of as a condition to be avoided, and yet all of us have heard people speak of being only pleasantly tired. No one would hesitate to place dis-

liking among the typically unpleasant states. Nevertheless people sometimes get a great amount of enjoyment out of disliking. A wicked enemy, whom one feels thoroughly justified in disliking, adds substantially to the satisfactions of life. While it is important to note which feelings are usually pleasant and which are usually unpleasant, it is also important to note that hardly any feeling states are invariably either pleasant or unpleasant, and that under the proper conditions most of these states may be either.

Emotions are a variety of feeling states. — Feeling states, as we have seen, have to do directly and principally with the bodily condition of an individual rather than with what is happening in the surrounding world. Nowhere is this more clear than in the case of that class of feelings known as *emotions.* Indeed, we might almost say that emotions are the most typical forms of feeling, because they are so clearly internal States. If I feel dislike for a man, it may seem not so much that the disliking is a condition I am in as that the man possesses the attribute of disagreeableness. In fact, I may be unable to note that a bodily change has taken place in me as I became aware of this disliking. If, on the other hand, I experience *an emotion* of anger upon seeing the same man, I shall be definitely aware that I, as an individual, am in a disturbed condition.

Emotional activity is more intense and definite than that during most feeling states. — The organic conditions of liking, cheerfulness, boredom, and many other feelings are mild and somewhat vague. It would be very difficult for one to give an account of the difference between his bodily condition when he is bored and when he is cheerful. In fact, these states are often so delicate and subtle that careful observation is required to make sure that they involve bodily states after all. The bodily conditions in emotion, however,

have a degree of intensity and vividness which makes their description somewhat less difficult.

Carl Georg Lange, one of the most noted students of emotional states, has given us the following picture of joy:

He [the joyful one] feels an increased motor impulse, moves swiftly and alertly, and gesticulates violently. Children jump, dance, clap their hands for joy. The facial muscles contract . . . and become round compared with the long, lax, hanging features of the melancholic person. Smiling and laughing are the result of the heightened impulse of facial and breathing muscles, as are also the high-pitched voice, singing, rejoicing. . . . The general dilation of the capillaries in joy results very strikingly in an increased flow of blood to the skin. A child's or a young girl's skin, which is white and transparent, reddens and glows with pleasure. The joyous person feels warm, his skin becomes fuller, he swells with pleasure.[1]

In anger, as in joy, there is usually an increase in muscular activity and tension and also an increased blood flow to the skin. Yet the anger reactions are apt to be more violent and less controlled than those in joy. The angry person may strike at friend and foe alike so strong is the impulsion to muscular activity.

In some cases where there is a certain amount of self-control, he merely strikes the table with his fist, bangs the door, tears something to pieces or otherwise destroys it. He would like to demolish the earth, and he may evince a power in his rage that exceeds anything he is able to do under normal conditions.[2]

In sorrow there is, as Lange tells us,

a feeling of lassitude, and as in the case of any fatigue, the movements are effected but slowly, and languidly, with effort,

[1] *The Emotions*, edited by Knight Dunlap, pp. 44–45 (Williams and Wilkins Company).

[2] *Op. cit.*, p. 51.

want of power and pleasure. . . . This also accounts for the external expression by which a sorrowful person is so easily recognized. He walks slowly, uncertainly, dragging his steps and letting his arms hang limp at his sides. His voice is weak and thin, as a result of the weakened activity of the expiratory and laryngeal muscles. . . . His neck is bent, his head droops — "cast down," "bent" by woe, — his face is lengthened and narrowed by the laxity of the muscles of the cheek and jaw; his jaw may even hang down. . . . Many are so overpowered by sorrow that they cannot even hold themselves erect. The sufferer leans on or supports himself by the surroundings, falls on his knees, or in desperation even throws himself upon the floor as Romeo did in the monk's cell.[1]

Lange held that fright is closely related to sorrow.

We find the same paralyzing effect on the voluntary motor apparatus, the same convulsive conditions of the constrictor muscles, only we find both appearing more suddenly and in a more exaggerated degree. To this, however, we must add another condition which we did not observe in the case of sorrow, namely a similar convulsive contraction of other organic muscles. . . . The essential physiological difference between sorrow and fright lies in the fact that in the latter, the convulsive, spasmodic condition of the voluntary muscles is shared by all muscles as far as can be judged, whereas in the former it is limited to individual groups of muscles. . . . A man is "burdened with," "weighed down by," "bent with" sorrow, but he is "paralyzed" with fear, is motionless, petrified, transfixed by fright. . . . A person overcome by a sudden fear may fall down paralyzed, or the innervation of the muscles at least may be so uncertain as to make him quake, tremble, stammer with fear.[2]

We must add to this description, of course, the fact that fright of not too intense a nature may show itself in well-coördinated and efficient movements of flight rather than in anything resembling paralysis.

[1] *Op. cit.*, pp. 40–41. [2] *Op. cit.*, p. 46.

Feeling states involve the most vital processes of the body. — Especially in such powerful feeling states as the emotions, pronounced changes take place in the most vital of the bodily processes. The blushing, flushing, and turning pale which are so frequently observed during emotional excitement bear witness to the important involvement of the circulatory system. The palpitation of the heart and the occasional suffocating sensations that one feels during emotion also indicate important changes in the functioning of this system. The respiratory or breathing system clearly plays an important part in emotional action. Usually conditions of general excitement are featured by a sharp increase in the breathing rate. In sudden fright, such as is set up by an unexpected fall, or more familiarly by the rapid descent of an elevator, there is a "catching of the breath" which amounts to a marked departure from the regular breathing activity of ordinary life. Everyone knows how severely digestion may be disturbed by emotional excitement. During anger, sorrow, or fear one is likely to lose his appetite. Food taken under these circumstances is not digested normally. Even nausea and vomiting may follow the disturbances of the digestive organs which take place during strong emotions. In fact, the disturbances are, themselves, important elements in strong emotions.

Certain sorts of feelings are accompanied, or followed, by a more healthy action of the bodily processes. When happy companions at dinner arouse in one a feeling of cheerfulness, they arouse at the same time a keener appetite. Every skillful physician knows how necessary it is to keep the recovering patient in an optimistic mood.

The extent to which the important bodily processes are affected during periods of strong feeling or emotion can be illustrated in another way. We have described how, during

the experience of joy, there are important changes in circulation, muscular tension, facility of movement, and the like. Now it is also possible to show that once the major changes in bodily processes observed in joy are under way, we then have the actual feeling or emotion. Many people feel gloomy and pessimistic when they arise in the morning. This is not because the world is actually more threatening at that hour, but rather because circulation is not vigorous, the muscles are almost painfully relaxed, and there is a general sluggishness of bodily processes. A hot breakfast and a short, brisk walk stimulate circulation, breathing, and the tone of the muscles, and one soon finds himself in the most cheerful frame of mind. Certain drugs act upon the vital organs of the body and bring about changes in their functioning similar to those changes that occur during ordinary emotional states. The result is that a person who has taken a dose of such a drug soon finds himself in the feeling or emotional state characteristic of his organic condition. Moderate doses of alcohol set up in most subjects a joyful state. They feel that everything is going beautifully, that the remarks that they make and that those about them make are unusually clever. As a matter of fact, everything that the alcoholic does is likely to be done with diminished efficiency. His joy is composed of his bodily reaction to a drug, and not of his bodily reaction to any occurrence that sober men would rejoice about. Still, the bodily reactions are somewhat the same as they would be with proper cause, and so is his state of mind.

There would be no emotions without the general bodily activity observed in emotional states. — James and Lange were early defenders of the view that bodily activity such as we have been describing is more than an important feature of emotion. They held the doctrine that without this

bodily activity there would be nothing deserving the name of an emotion. This conception is known among psychologists as the James-Lange theory, after these two men who were its champions. James's own statement of the case is exceptionally vivid.

> What kind of an emotion of fear would be left if the feeling neither of quickened heart-beats nor of shallow breathing, neither of trembling lips nor of weakened limbs, neither of goose-flesh nor of visceral stirrings, were present, it is quite impossible for me to think. Can one fancy the state of rage and picture no ebullition in the chest, no flushing of the face, no dilation of the nostrils, no clenching of the teeth, no impulse to vigorous action, but in their stead limp muscles, calm breathing, and a placid face? The present writer, for one, certainly cannot. . . . In like manner of grief: what would it be without its tears, its sobs, its suffocation of the heart, its pang in the breast-bone? A feelingless cognition that certain circumstances are deplorable and nothing more.[1]

C. The Origin and Development of Our Feelings

Many of the conditions of feeling are inborn. — The new-born infant does not have to learn to feel hungry. The feeling of hunger depends largely upon the physiological conditions of the stomach when it is empty, and previous experience is unnecessary in order for this condition to be present. In a similar way the feelings of thirst and nausea are dependent upon the very make-up of our vital organs rather than upon the experiences that we undergo. Well-being and malaise, cheerfulness and depression, energeticness and tiredness, tension and calm, and many other feeling states are also dependent for the greater part upon the kind of a body with which we are endowed at birth.

There is present practically from birth a capacity for certain of those intense feeling activities called emotions.

[1] *The Principles of Psychology*, Vol. II, p. 452 (Henry Holt and Company).

This is certainly true of fear, anger, and joy. Dr. John B. Watson's investigations of the emotional life of infants have added greatly to our knowledge about this matter. He found that fright was manifested even by babies who were too young and too carefully guarded to have seen fright in older persons. These children also showed joy (called "love" by Watson) and anger upon occasion.

The external conditions under which these emotional reactions take place in very young infants are remarkably definite. They are also remarkably few in number. Definite fear reactions, such as sudden catching of the breath, random clutching with the hands, sudden closing of the eyes, and crying, appear in the presence of loud sounds or removal of bodily support. The latter condition was attained in Watson's experiments by dropping the child upon a soft feather pillow. Other stimuli, which one might naturally expect to arouse fear, fail to do so in the case of these inexperienced infants. Watson presented to a child strange animals, a cat, a rabbit, a pigeon in a bag, and a dog, without eliciting a fear response, even though these creatures were in some instances brought into actual contact with the child. The one stimulus which seems capable of arousing anger or rage in a very young infant is the restraining of his movements.

If the face or head is held, crying results, quickly followed by screaming. The body stiffens and fairly well-coördinated slashing or striking movements of the hands and arms result; the feet and legs are drawn up and down· the breath is held until the child's face is flushed.[1]

Gurgling, cooing, and other elements of joyfulness appear upon gentle stroking of sensitive parts of the body, tickling,

[1] *Psychology from the Standpoint of a Behaviorist*, 1924, p. 220 (Lippincott).

shaking, gentle rocking, patting, and turning upon the stomach.

Experience alters the conditions capable of arousing feeling. — As bodily growth progresses, important changes naturally take place in our digestive, respiratory, and other vital systems. Since our feeling states are made up in large measure of conditions which obtain under certain circumstances in the vital systems of the body, it is undoubtedly true that these changes accompanying growth bring about some alterations in the internal constitution of our feeling states. It is quite possible that we experience feeling states in early childhood which could not occur in the adult body, and it is certain that the fully developed adult is capable of some states of feeling of which there is little evidence in infancy. There seems to be, nevertheless, in the case of hunger, thirst, nausea, tiredness, cheerfulness, joy, anger, fear, and many other feelings, an essential similarity between the internal constitutions of these states throughout life.

There is another fact that is of considerably greater consequence for mental life than the occasional internal modifications undergone by feeling states. Almost every day's experience produces in each of us some alteration in the conditions capable of arousing this or that feeling state. An open fire warms us and arouses cheerfulness. Later if we look from the cold out-of-doors through the window at an open fire, we may be made cheerful by the very sight of the fire. The sight of a fire, the warmth of which we do not actually feel, is not an original, but rather an acquired condition of cheerfulness. The majority of the conditions that cause rejoicing in the adult are conditions that do so only because of personal training and experience. The sight of a check for a million dollars made out to himself would not bring about joy in an infant or a savage. Experience is

required for one to recognize the meaning of words of praise, and only when the meaning is known can such words arouse joy. As a result of experience one may also cease to rejoice in the presence of formerly enjoyable conditions. The sight or thought of a circus, a baseball star, or a chocolate sundae no longer thrills me as it once did.

Education changes likes and dislikes. — A thorough education does much more than add to one's knowledge. It also cultivates new and valuable likes and dislikes. Persistent endeavor along one line usually brings about restlessness and discomfort in a child. The disciplining effects of time and experience are necessary to create an enjoyment in work itself. Some people never get beyond the state where they work simply because they have to work in order to secure a desired result, such as praise or money. Others actually learn to like the work itself. The value of such an attainment is clear when we consider what a great proportion of our lives most of us have to spend in working. Some people are disturbed and unhappy whenever they are confronted with a problem which they are unable to solve at once and without effort. Others get to a point where the challenge of many sorts of problems is really enjoyed. It is almost needless to say that the latter group is the one that is the more likely to get on in life and to effect achievements of first-rate importance.

Only education can make one like a great work of art and dislike a poor one. Indeed, some of the finest tastes of human life can be acquired only as a result of considerable cultivation. Young children of little or no musical experience like simple melodies, but most of us must listen many times to the more intricate forms of music, such as those found in symphonies, before we are capable of feeling a genuine enjoyment of them.

Those tastes which are acquired only as the result of considerable experience are likely to furnish more permanent enjoyment than those which are born in us or which are acquired very easily and quickly. The former have to do especially with complicated matters, with the more highly developed forms of art, business, science, and the like. By virtue of their very complexity, these things furnish almost limitless possibilities for enjoyment after one has once gone to the trouble to become acquainted with them. We are all familiar with the fact that a person soon gets tired of too much candy, too many roller-coaster rides, too many puns, or too many detective stories. None of these contains enough variety to keep one pleased continuously for a great length of time. But this variety is just what is furnished by the objects of cultivated taste. Fine poetry, chemistry, modern financial institutions, furnish an almost endless variety of interests to the man who has become schooled to understand them. Once the multitude of charms offered by such subjects has been felt, there is little possibility of their ever being laid aside through boredom.

Many men get to the point where they find continuous enjoyment in their life work, and many women get to the point where they find continuous enjoyment in the management of a household. More than one fairly elaborate set of interests, however, are desirable, if not actually necessary, for a healthy and happy mental life. No matter how full of variety one's principal occupation may be, recreation of some sort is necessary. And there is nothing so likely to make a man or woman regular in seeking recreation than the possession of a hobby which, itself, offers a wide range of interests and pleasures. Long walks are beneficial, but one is much more likely to take them regularly if he has cultivated a taste

for observing geological formations or the kinds and habits of birds. Men, when they retire from business, and women, when the growing-up of their children has relieved them of domestic responsibilities, often find themselves exceedingly restless and unhappy, because during the previous years they have not developed capacities for enjoyment to which they can now devote themselves. They may turn to politics only to find that their knowledge of such matters is insufficient to make the subject an interesting one. They may try traveling only to find that lack of information about the people, the art, the customs, the industry of the places they visit, renders impossible anything but the most superficial interest in these new scenes.

Moral education is a cultivation of wise likes and dislikes. —The enjoyment of good deeds and the feeling of revulsion in the presence of evil is a product of proper training. The voice of conscience refers to that inner discomfort which arises when a morally sound individual commits an unworthy act or entertains the notion of committing such an act. There is an opinion sometimes held that every moral reaction should result from an elaborate process of reasoning on the part of the person making that reaction. As we have previously shown, this view is erroneous. While it is well for us to know why this type of conduct is praiseworthy and why that type is to be avoided, we should lead laborious, uncertain, and inefficient lives if we had to stop and consider all the conceivable arguments for and against every possibility of conduct which confronts us. In the well-organized individual, honesty, kindliness, unselfishness, are so strongly established as principles of conduct that, under all ordinary circumstances, the mere thought of violating them arouses, immediately and without pondering, a strong feeling of revulsion.

Experience sometimes alters the conditions of feeling in undesirable as well as in desirable ways. — The experiences which we have, if we are surrounded by the proper influences, produce valuable interests and capacities for enjoyment and also equally valuable and worthy dislikes. There is the possibility, too, if we are surrounded by the wrong kind of influences, that our experiences may produce undesirable habits of feeling. We may, for example, acquire the unjust habit of disliking all foreigners and others whose manners and customs are not like our own. We may acquire a strong antipathy for all religious beliefs but our own, without learning to admire the meritorious elements that almost every religion contains. There is always present the necessity of guarding against the acquisition of prejudices of this kind. This does not mean that we should guard against strong feelings of liking and disliking. Without strong feelings of any sort a man would be a forceless creature. Neither does this mean (and we have made this point before) that one should reason out a justification for his feeling every time he experiences such a state.

The practical fact is that we should, from time to time, consider what feelings tend to dominate our lives and affect our conduct in important ways. We then may ask ourselves whether sound or unsound influences have created those ways of feeling and whether we ought to remove certain influences that determine our feelings, or whether we ought to remove ourselves from these influences, in order that our feelings may become modified in a fashion worthy of our better ideals. I may suddenly realize some day that the very mention of a particular statesman's name arouses a powerful feeling of loathing and disgust. Under these circumstances it is only fair to my better self that I ask why I have such a strong feeling against this man. My ques-

tioning may make it clear to me that all I have ever learned about him has been learned from the pages of a newspaper which represents a political party opposed to him. If I have reason to suspect that the paper is not always motivated by considerations of fairness and truth, I may do well to seek facts about the statesman's career at another source, in order that my feeling in regard to him may be established upon a fairer basis.

On the other hand, my study of the case may convince me that the man really is a rascal and that my feeling about him is fully justified. In that event there is no reason why I should try to remove my dislike for him or for the political corruption which he represents. A little reflection may make clear to me that my dislike for a particular dish which is frequently set before me cannot be a justifiable dislike. Others partake of it with enjoyment. Perhaps my own dislike of it is simply a habit acquired during childhood. Perhaps on some occasion during that period I made myself sick through eating too heartily of it. Very often under such circumstances a happy modification of feeling habits can be brought about simply by ignoring the irrational dislike until it is no longer troublesome. This procedure will not always work, but when one possesses a petty dislike which is continually proving an embarrassment, the method is well worth trying.

Unreasonable fears are frequent and unfortunate acquired feelings. — The fearless daredevil is not the best-balanced person in the world. His very fearlessness makes it easy for him to expose himself to all sorts of dangers, one of which may some day prove his undoing. A person is actually better off if he has a certain amount of honest fear of neglecting his health, of going a mile a minute in a motor car, or of sailing a canoe far from shore on rough water.

Many of us, however, possess, in addition to, or instead of, these reasonable, advantageous fears, others which are neither reasonable nor advantageous. Fears of this latter class are commonly known as *phobias.*

The fear of mice and the unwarranted fear of catching some dread disease are examples of feeling habits which we are better off without. One difficulty in the way of ridding ourselves of unreasonable fears is that more often than not we know nothing of their origin. Dr. Coriat tells of a woman who "developed a fear of closed places because on one occasion, while in a state of fatigue, during a visit in a small, close room, there arose a slight fainting attack. In still another case there developed a fear of crowds because, some time previously at a crowded school celebration, the patient became slightly overcome by heat and felt like screaming."[1] Such persons, as Dr. Coriat goes on to say, are frequently unable to recall the event which first gave rise to the unreasonable fear. And where the original cause can be remembered, the sufferer, as likely as not, is unable to see any relationship between it and the phobia.

Three methods of removing phobias. — The simplest method of removing unreasonable fear is that of keeping the sufferer away from anything capable of arousing it. One might, for example, adopt every precaution for preventing the person in question from seeing a mouse, from being reminded of sickness, or from getting into a closed place or into a crowd. This method has obvious shortcomings. While the absence of the stimulus with which the fear reaction is unreasonably connected may in time lead to the actual breaking of that connection, there are perhaps just as many cases where nothing of the kind will happen. We may keep the person who is afraid of crowds away from

[1] *Abnormal Psychology*, p. 279 (William Rider and Son, London).

crowds, but there is little guarantee that her fear will not be as strong as ever if our protection for one reason or another fails her.

There is one type of situation in which the mere prevention of the occurrence of the fear by keeping the person away from the fear stimulus is justifiable and useful. If the fear reaction is so violent that it imposes a severe strain upon the frightened individual and possibly threatens his health or sanity, there is wisdom in protecting him from contact with the fear stimulus in order that he may reach that state of calm necessary for the application to his case of more thorough means of removing his phobia. The important point is this, that protection from contact with the fear stimulus will seldom, of itself, make the sufferer capable of meeting the stimulus without fear. And of course that is what is desired. The phobia should be so thoroughly removed that the former possessor of it becomes capable of facing the fear stimulus and reacting to it in a normal, healthy fashion.

Another, the second, method of removing phobias is quite like the method which we suggested for removing unreasonable dislikes for certain dishes. Our suggestion was that one take himself in hand and eat olives, mayonnaise, and whatever he dislikes, and keep on eating them each time they are placed before him. In many cases one will become adapted in this way to whatever he does not like about these dishes, so that he will cease to dislike them so heartily. In fact, under circumstances like these, one will often develop a genuine liking for the formerly neglected food. Phobias are occasionally susceptible to this form of treatment. White rats are used to a considerable extent in the study of animal psychology. Many girls exhibit great fear when they are first required to work with and even handle these little beasts. This unreasonable fear is soon lost entirely in

the majority of cases. Most of us have from time to time irrational fears which become removed by the simple process of getting used to the emotion-educing stimulus.

There are conditions, it must be admitted, under which it is unwise to attempt the removal of a phobia by continuously confronting the person with the object of which he is afraid. This is true if the fear aroused by that object is a violent and deep-seated one. I remember a small child who in some way or other had become dreadfully afraid of false faces. He would scream in terror at the sight of a person wearing one of those hideous affairs. If an attempt had been made to cure this child's fright by exposing him to false faces upon all possible occasions, the result might have been lamentable. Such powerful fears as his may easily be accentuated if promiscuously stimulated. Fear, too frequently experienced, is likely to give rise to habits of worry and apprehension, and these latter conditions tend to make one more and more subject to violent states of fright. The belief was once commonly held that, if a child is afraid of the water, his fear can best be cured by throwing him in. This scheme may work well enough provided the child is not too much afraid and providing he is not too nervous and excitable. If he is nervous and excitable, such methods are more likely to create an incurable phobia which no amount of future training can eradicate.

A third means of removing phobias is that of getting the subject to a point where he can take a rational attitude toward his fear. Although this method is often slow and difficult, it is the safest, and usually it leads to the most permanent results. Perhaps the majority of unreasonable fears are attributable to some particular, unpleasant experience. The fears of closed places and of crowds mentioned by Dr. Coriat are cases in point. If the subject of a phobia

can be made to understand that his fear is based upon some relatively trivial experience, he is in a favorable position to gain control over his unreasonable emotion and ultimately to uproot it.

As we have said before, the sufferer from a phobia is often unable to remember the circumstances under which his fear first was felt. Sometimes the forgotten experience can be remembered if the subject is encouraged to think about the matter persistently enough. But there is a good chance of meeting the fear upon rational grounds, even if one cannot get at its actual origin. Although the effort to discover why a certain person is afraid of dogs, that is, what early experience or experiences gave rise to this particular fear, may be unsuccessful, there is still the possibility of convincing him that few dogs are actually dangerous, that other people are not afraid of dogs, and so on. On this basis he may begin to reason with himself, and as soon as he begins to look upon his own fear as an intellectual problem in need of solution, the chances of his losing that fear are very good. It is common knowledge in psychology that, when one begins to observe his own experience in a calm way, emotional states tend at once to lose their intensity. And this principle is a most helpful one, not only in the case of unreasonable fears, but also in the case of prejudices and other unreasonable feelings.

Poor health is sometimes the basis for undesirable feeling states. — Phobias, prejudices, and other unfortunate feeling tendencies are in perhaps the majority of instances based upon something in the individual's experience. That is to say, they are simply bad habits, and their cure is a matter of habit breaking. Unreasonable fear and anger is, however, sometimes more a matter of health than of past experience and training. We have seen how fear and anger contain as

essential ingredients disturbances in circulation, breathing, and other vital bodily processes. We have seen also how drugs which act directly upon the vital organs may arouse an actual emotional state. Bad health, and good health too for that matter, may act in much the same manner. Poor digestion or circulation is very likely to be a factor in prolonged states of worry or irritability. A vigorous, healthy condition of the vital functions of the body is just as likely to mean a strong disposition to be courageous and joyful.

These prolonged dispositions toward feeling states of a certain type are, of course, what we usually refer to as *moods.*

Moods are matters of habit as well as of health. — The wrong type of food, too much stimulation or too little, insufficient sleep, eye strain, and other similar factors are important causes of unhappy moods. Under such circumstances the surest method for removing the worry, irritability, and depression of the moody one is to get him to change his living habits. A wise physician, when consulted, is often able to suggest some apparently minor change in one's habits, such as a reduction in the amount of meat eaten or an increase in the amount of time spent out of doors, and such changes may have a striking effect upon the general feeling tone of one's life.

In our discussion of emotional states we told how these states, when set up by external stimuli — a loud and sudden sound, for example — involve profound changes in the operations of the vital organs. Then we proceeded to show how an emotional state, such as that of joy, can be produced by drugs acting directly upon the internal systems of the body. We may well hold these facts in mind during our consideration of moods. We have shown how bodily healtb

predisposes one to certain kinds of feelings. Now, the reverse is also true. Anger and fear, if we give way to those states too frequently, will have actually bad effects upon general health, and this impaired health will mean an increasing disposition to become angry and afraid. So that, even in those cases where worry and irritability depend immediately upon imperfect health, the imperfect health may be traceable to unfortunate habits of giving way to such feelings.

Temperament consists of one's emotional habits. — Each of us has his own peculiar emotional habits. Some persons throughout their lives become angry upon the slightest provocation. Some have an unusually strong tendency to worry and fret. Some seem to have an irrepressible habit of being cheerful. Some are easily stimulated into a state of fear, anger, or joy. Still others are not easily stimulated into any sort of an emotional reaction. Such characteristics as these are what we know as *temperament*.

There is no doubt that temperament is to some extent inborn. The most tragic life circumstances are, in the case of some persons, incapable of destroying a dominant tone of joy. The most favorable circumstances are, in others, incapable of overcoming an equally dominant tone of irritability and worry. Nevertheless, in many cases temperament is determined to an important degree by experience and training. The assumption is often made that the different races of mankind possess inherent differences of temperament. The French, the Spanish, the Italians, and other peoples from the south of Europe display emotional reactions more fully and more frequently, according to a prevalent opinion, than do the peoples of northern Europe. Now, the question arises as to the degree to which this alleged difference in emotional excitability is the result of inborn, physiological

characteristics of the peoples and the degree to which it is the result of experience. While no final answer can at present be given, this much can be said: The difference in training between an Englishman and an Italian and the differences between their environments might reasonably explain vast differences in temperament.

Another frequent assumption in regard to temperament is that those inborn capacities which make it possible for certain rare individuals to achieve great things in art or science or in some other line of human endeavor are accompanied by an inborn emotional excitability. Even though it be true, and there are reasons for believing that it is, that the genius is more prone to manifest emotion than the general run of mankind, we need not accept the doctrine that this peculiarity of genius is mostly inborn. Indeed, we may well realize that the man of unusual talents is often treated by those about him much as the typical spoiled child is treated. Because of his talents, even his relatives may stand in awe of him and cater to his every wish. Under such circumstances we should hardly expect anyone to develop a great amount of self-control. One needs to gain a regard for the opinion and feelings of those about him before he can be expected to suppress the emotionality and impulsiveness characteristic of childhood. When an individual gives early evidence of remarkable intellect or artistic skill, the shaping and disciplining forces of education are not likely to be applied to him with the vigor and persistence with which they are applied to the ordinary child. As a consequence it is no wonder that many geniuses are impulsive and excitable, that so far as their emotional habits are concerned they remain childlike and undeveloped.

There is evidence too that the temperaments of the ordinary mortals with whom we are acquainted are deter-

mined to a large degree by training and environment. If a child's mother shows fear whenever the slightest threat occurs against the family welfare, if she is plainly terrified, for example, whenever a member of the household is sick, the chances are that the child will be strongly affected by her example. I know a woman who, when she cannot convince her husband of her need for money for a new hat, indulges in the unpleasant practice of screaming and sobbing in turn. It is not surprising that her daughter, now a grown woman, has similar emotional habits.

If a child is brought up in surroundings where emotional control is exhibited by others and where he is made to see quite clearly that self-control is expected of him, the results are often marked. I well remember the type of family influences which acted upon the happiest and most courageous little four-year-old whom it has ever been my pleasure to know. One day David was playing on the lawn with a group of older boys. In the midst of the play one of the older boys lost his hold upon David and the latter fell violently to the ground and landed squarely upon his head. Everyone there except his parents, who happened to be looking on, expected him to burst out crying, at least by the time he had regained his feet. When he did scramble up, which was promptly, because his fall was painful rather than serious, he looked over toward where his mother and father were sitting. They returned his gaze as if nothing had happened that was at all worth getting excited about. David frowned a little, rubbed his head once or twice, and then signified that he was ready to resume the play. What a difference there would have been in David's character if his mother in such situations had rushed to his aid, taken him into her arms, and inquired in a quivering voice whether her darling were hurt!

Why effect of experience upon feeling habits is important. — We have stated that one's disposition toward feelings of joy or feelings of depression, or one's disposition toward feelings of every kind, may have a certain basis in one's inborn constitution. But we have in our discussion emphasized the fact that experience and training have a great effect upon our emotional habits. And we have a very good reason for this emphasis. While society tries to control the kinds of individuals who come into the world to the extent of preventing, wherever possible, the marriage of those who are clearly insane or feeble-minded, and who might therefore be expected to have mentally unfit children, that control is not at all a strict one. Society still has all sorts of individuals with whom to deal and out of whom to make useful human beings. Now the principal hope that society has in this task is to be found in the possibilities of education and training, and it is largely to the extent to which such training and education can be effective that these problems are solvable by any practical scheme. It may be that a child's violent temper and fits of depression are mainly attributable to his inborn constitution. Our own main concern must be with the possibilities of effecting, through training and also through precautions as to physical health, the control of the child's moodiness. In other words, those characteristics of emotional life which are set at birth and unalterable during life are things about which we can do little or nothing. But those characteristics of emotional life, on the other hand, that are susceptible to change by experience are things about which something can be done. Therefore they are the ones which merit our main concern.

Experience organizes our feelings. — Experience does more than determine simple connections between objects, events, or ideas, on the one hand and states of feeling on the

other. We have said that we have systems of feelings as well as simple feeling habits. That is to say, a human personality is not made up of isolated, independent tendencies to feel angry, afraid, joyful, or sorrowful under this or that specific condition. Our habits of feeling are organized by our experiences into unified systems that operate in accord with particular ends and purposes. To quote from our own earlier statement of the case: "As patriots we rejoice at the sight of our country's flag, become angered when our national honor is assailed, become afraid if our national progress is threatened, and grieve if our nation loses a great friend or leader. To acquire a friendship is to acquire habits of rejoicing, becoming angry and afraid, and grieving, according to the varying fortunes of him who is the object of our friendship. To acquire an appreciation of literature is to learn to approve of the artistically meritorious and also to disapprove of that which is lacking in literary value."

D. Feeling and Other Forms of Activity

Feeling and reasoning are not opposite processes. — According to an old, old custom, we are inclined to think of feeling and reasoning as being in some way opposed to each other. When we ask ourselves whether so-and-so is going to be ruled by his heart or his head in reaching a decision, we imply that feeling and reasoning bring about different — indeed, opposed — modes of conduct and that the two do not go on at the same time. Such a view, however, does not correspond with the facts. In reasoning we consider a number of ideas before reaching a final conclusion, by expressing either to ourselves or in our conduct a choice for this or that idea. But why, in the last analysis, do we select one idea rather than another? The only answer to such a

question is that our mental decision or our actual conduct takes one form rather than another, because the strongest feeling occurs when that possibility is tentatively considered. Now, of course, if we have powerful prejudices, fears, joys, attached to or associated with what for our own good they ought not be associated with, such feelings will alter the outcome of what reasoning we do. But under such circumstances bad decisions are not the result of the fact that our conduct is governed more by feeling than by reasoning. The difficulty lies in the fact that these particular habits of feeling happen to make a successful outcome to our reasoning impossible.

In the preceding chapter we made much of the point that efficiency and reliability are not to be judged from the mere fact that one does much reasoning. Efficiency and reliability must be determined by the results of reasoning, upon whether the conclusions reached are true or false. Now, in so far as feeling interferes with truth it does so, not by interfering with the process of reasoning, but rather because it enhances the apparent value of erroneous ideas and fails to enhance the value of those ideas which, in the interests of accuracy and truth, should dominate our reasoning. Under such conditions the process of reasoning is just as much a process of reasoning as ever. The trouble is, to speak figuratively, the process is pointed in the wrong direction.

As a matter of fact, feelings are just as responsible for our reaching correct conclusions, when we do so, as for our reaching incorrect conclusions when we do that. The sound thinker is set into as vigorous a feeling state by an idea which is true and worth adopting as is a fool by the erroneous idea, the adoption of which marks him as a fool.

Feeling has effect upon all forms of behavior. — We have shown how that type of activity called feeling is intermingled,

in actual life, with other activities. The art lover *likes* the picture while he is perceiving it, or remembering it, or thinking about it. The baseball fan *feels excited* while he perceives, remembers, or imagines the home run with three on bases.

Feeling not only goes on simultaneously with other activities; it is so inseparably bound up with those other activities that it affects them in very important ways. When, in reasoning, we consider in ideational form, a number of alternatives, our final choice, as we have seen, is determined to a large degree by the particular feelings present with our different ideas. Our feeling activities have great influence also upon our perceiving, remembering, and imagining. He who is afraid of the bad opinion of others will perceive a host of slights where no slights are intended. He who fears that he has made a blunder will magnify his error in the act of remembering it. He who is worried about retaining his job is likely to imagine that his superior has thoughts of discharging him, although there are no grounds for such imaginings.

The effects of feeling also extend into our completer actions — our bodily movements. Before a football game it is customary for many coaches and captains to arouse their men to a high pitch of excitement, because it is recognized that the energy and vigor of their play will thereby be enhanced. We are all familiar, too, with the fact that feeling may decrease efficiency of behavior. If the football player is unreasonably wrought up, this condition may make him run harder, but it may also lead to fumbling of the ball and to confusing signals. Whether our actions are to be increased or decreased in effectiveness by the feelings with which we embark upon them depends both upon the type of action and upon the type of feelings involved. A high pitch of emotional excitement may be an

advantageous preparation for strenuous muscular exertion, but usually action which must be accurate is better prepared for by feeling of less intensity. The boxer should feel energetic and confident as he goes into a bout, but he must not be so energetic and confident as to take unnecessary chances with his opponent. The same is true even when we embark upon intellectual undertakings. The salesman does well if he can work up in himself a certain amount of enthusiasm before approaching his prospective customer, but he also requires sufficient calm to prevent preposterous statements about the merits of his goods.

Summary of the Chapter

1. Feelings differ from cognitions in that they usually have to do more with the internal condition of the individual than with objects and events around him, and in that they are relatively diffuse and indefinite. There is not, however, a sharp line between the two.

2. There are a great many kinds of feelings. Some of these are usually pleasant; they are of such a nature that we wish for their continuance, while others are usually unpleasant.

3. Emotions are more intense and more definite than most feeling states. They depend upon the most vital of the bodily processes.

4. Feelings, emotions, moods, and temperaments are greatly influenced by training and education. They are also dependent upon inborn conditions and upon bodily health.

5. Experience determines what stimuli will arouse this feeling or that. Experience also organizes our feelings.

6. Feeling and reasoning normally work together and are not necessarily opposed as common opinion often assumes.

7. There are hardly any of our activities that are not importantly affected by feeling. Perceiving, imagining,

remembering, and bodily movements are modified by the feeling states that precede or accompany these processes.

PROBLEMS

1. Make a list of ten experiences of your own which lacked any prominent feeling. Make a list of ten other experiences in which feelings were prominent and important constituents.

2. Why is it harder for us to be definite in our descriptions of feelings than in our descriptions of cognitive processes?

3. Enumerate some feelings which are ordinarily pleasant, but which are capable of becoming unpleasant.

4. Why is it that we do not have to learn by experience how to be tired or energetic, tense or calm, cheerful or depressed?

5. Upon which does our general health have the greater influence, our cognitive or our feeling activities? Why?

6. In what manner is it possible for our feelings to become modified as a result of experience?

7. How would you help a young child to get rid of a strong hatred for one of his playmates?

8. Show how the temperament of the "spoiled" child is produced by the people about him.

9. What experiences have produced in you that organization of feeling habits called *patriotism?*

REFERENCES FOR FURTHER STUDY

Dunlap, *The Elements of Scientific Psychology*, pp. 312–314; or *Readings in General Psychology*, Ch. XVII, Selection 2-C, p. 446 ff.

Münsterberg, *Psychology, General and Applied*, pp. 198–199; or *Readings*, Ch. XVII, Selection 3, p. 448 ff.

Marshall, *Pain, Pleasure, and Aesthetics*, p. 191; or *Readings*, Ch. XVII, Selection 4, p. 449.

Ebbinghaus, *Psychology* (tr. and ed. by Max Meyer), pp. 164–166; or *Readings*, Ch. XVII, Selection 5, p. 450 ff.

Lange, in *The Emotions* (ed. by Knight Dunlap), pp. 33–34; or *Readings* Ch. XVIII, Selection 1, p. 452 ff.

Stout, *A Manual of Psychology* (3d. ed.), pp. 405–409; or *Readings*, Ch. XVIII, Selection 2, p. 453 f.

James, *The Principles of Psychology*, Vol. II, 449–453; or *Readings*, Ch. XVIII, Selection 3-A, p. 456 ff.

Watson and Watson, *Scientific Monthly*, 1921, pp. 505–514; or *Readings*, Ch. XVIII, Selection 8, p. 480 ff.

PART VI

THE INDIVIDUAL

CHAPTER XIV

PERSONALITY

A. Personality and How We Know It
B. The Organization of Sound Personality

Questions to Keep in Mind while Reading this Chapter

1. What is personality?
2. What makes for soundness of personality?

There are certain characteristics common to all human nature. Bodily movement, perception, thought, feeling, and every other type of human activity depend in an intimate way upon the structure and the operation of the nervous system. This is true for everybody, and it can scarcely be said to be more true for some than for others. Wherever there is human nature we may expect to find learning, and habits which result from such learning. Furthermore, there are general laws according to which learning takes place. The degree to which an act is fixed, for example, is affected in important measure by the frequency with which it has been repeated. This law of repetition is not an individual idiosyncrasy — is not a law which holds true in the learning of some people, and not in that of others. It is a law which operates wherever learning takes place. And so we might go through a long list of psychological principles and find that they are manifested wherever human nature appears. In fact this is exactly what we have done in the preceding pages. While we have mentioned individual

peculiarities from time to time, our main emphasis has been upon those characteristics common to all human nature.

However, we have all observed that every person has peculiarities that distinguish him from others and give him his *individuality*. We cannot deny the practical importance of these differences among individuals. In the next two chapters, therefore, we shall consider, in particular, the fact that individuals differ from one another in the habits they have formed, in the ways in which those habits are interrelated, and in the efficiency with which those habits operate.

A. Personality and How We Know It

An individual is an organized system of habits. — An individual is made up of countless reflexes, habits of moving, intellectual habits, and habits of feeling. But the habits do not exist in isolation. They are organized into systems of habits. The athlete's skill in throwing a ball is not to be thought of as an independent achievement. It is closely connected with his ability to catch a ball and to wield a bat. It is, in short, one element in a larger habit system known as baseball playing. The geologist's skill in recognizing and explaining the origin of some rock formation is only a small part of that larger skill which we call his knowledge of geology. The thrill which an American feels when he returns from a sojourn in Europe and first catches sight of the Statue of Liberty is only one of the several forms of feeling organized together into that system of feelings known as love of country.

Even the larger habit systems of an individual are not to be considered independent. They are, in turn, parts of a yet larger habit system. The athlete's skill in sport is likely to be related closely to his loyalty to his school. The lawyer's

mastery of his subject may be closely connected with his knowledge of related subjects, with his ambition to receive the recognition and praise of his colleagues, and with a number of the other systems into which his habits are organized. Patriotism is closely related to one's knowledge of his country's history and institutions, to his public spirit, and to his civic interest.

A human being, then, is not only a composite of countless simple habits. He is made up of systems of habits, and even these systems of habits are related to one another. By using the expression, related to one another, we really mean more than our words may seem to imply. We mean that these systems actually affect each other and determine each other's nature. The more ambitious the lawyer is for praise and promotion, the more assiduously will he pursue his subject. But if, at the same time, he is unusually fond of his family, he may hesitate to spend as much time in study as he would like. Thus, his love of family may act in partial opposition to his love of praise. On the other hand, he realizes that those financial rewards which will enable him to do more for his family depend upon his professional skill. So, from that point of view, his love of family may supplement his love of praise in driving him toward thorough study of his subject. We can readily see from this example how intricately each man's desires, feelings, manual skills, and types of knowledge are interwoven to make up his personality. In fact, his personality is, itself, a great system of habits.

How personality is revealed. — Although every one of an individual's habits is influenced to some degree by the other habits which he has formed, one's ordinary actions, considered by themselves, give little indication of the nature of one's complete make-up, of one's personality.

There are some who believe that much can be learned about the total man from the neatness of his dress, the vigor of his handshake, and other characteristics of this kind. Perhaps there is a little truth in this, but bad mistakes will be made if such indications of personality are taken too seriously. The neat dresser will often turn out to be a careless thinker, and the vigorous hand shaker a chronic procrastinator.

The complete make-up of an individual is adequately expressed in his behavior only during the course of years. A real knowledge of a personality, then, depends to a considerable extent upon the study of the history of that personality.

Personality is revealed in ideation. — Through ideation one can represent in the present many of the more important events of one's past life. Through ideation one can construct events that have never yet occurred in one's personal experience. It is owing to these facts that we can hope to learn much of a personality, even if we have not observed with care its past development, and even if many of its desires and fears have not yet appeared in actual behavior. If we can discover what a person is capable of remembering we shall know much of his important history, and if we can discover what he is in the habit of imagining we shall know much about the desires and fears which dominate his attitude toward the future.

How the physician studies personality. — In late years there has been an increasing recognition among members of the medical profession that many so-called nervous troubles are the result of a faulty organization of the patient's habits rather than a result of the ordinary forms of physical disease. The treatment of troubles of this type requires two definite steps. First, the physician must become thoroughly acquainted with the personality of his patient and, second, he must aid

the patient in effecting a reconstruction of personality. It is the first step in which we are particularly interested just now.

In order to learn as much as possible about the personality of his patient, the physician almost always asks a number of formal questions regarding illnesses, disappointments, and other obviously critical experiences which the patient has had. Sometimes the source of an individual's "nervousness" or personality disturbance can readily be detected in this way. In mild forms of personality disturbance, one does not normally consult a physician. For instance, people frequently take a disagreeable medicine with grape juice, lemon phosphate, or some other normally pleasant beverage, and later find the mere sight or smell of that beverage nauseating. In such cases the cause of this habit of unfavorable response is quite evident, and the person knows as well as anyone else the real cause of his trouble.

There are many types of personality disturbances, however, where the detection of the source of the difficulty is not such an easy matter. A man became troubled with palpitation of the heart. He underwent a thorough physical examination, but no explanation for his condition was found. Finally his physician began to study the mental make-up of the sufferer. In the course of this study the fact was discovered that the patient had worried about losing his position, but he had never thought of this worry as a possible cause of his heart difficulty. The physician, however, realized that this condition might easily be caused by worry, and so he proceeded to build up in the patient a feeling of greater security and assurance, and the palpitations soon ceased. This was a case where the *mental* source of a *physical* difficulty was not at all evident to the sufferer.

Much, therefore, can be learned of a personality by discovering what the individual is capable of remembering and

imagining and what are his hopes and fears. Sometimes such a study is called a *psycho-analysis*, but whatever its name, the procedure has certain definite features. The patient is encouraged to communicate to the physician what he can remember and imagine and to express his ideas freely. Though it may require many interviews to achieve a really thorough view, gradually the physician obtains a clearer understanding of his patient's personal organization. When the weak places are finally discovered, the process of retraining or reorganization may be commenced.

Of course it is only in rare cases that a personality requires exhaustive analysis by a physician, but we have discussed the method by which such an analysis can be made in order to show how one's complete organization or personality can be reached and understood through one's ideas.

How a person gets acquainted with himself. — We can easily realize that the understanding of another personality requires observation of the activities of that personality in a variety of situations. Thorough knowledge of another is not to be obtained merely by studying his facial expression or by engaging him in a single conversation. Similarly only prolonged experience can give a person an adequate knowledge of his own personality.

A very young infant makes no distinction between his own personality and other personalities. Nor does he make any distinction between persons and things. Only after considerable experience does he learn the difference between persons and things, and between himself, as a person, and other persons. When the first difference between persons and things is observed by the infant, it is in all probability based upon simple factors. Persons move about more than things, they make more sounds, and they touch him in a way that things do not. The appreciation of just such

simple facts as these lies at the basis of the child's notion of personality.

But how does he come to realize that he is, himself, a personality? Does he first appreciate the distinction between other persons and things and then later come to classify himself with the persons rather than with the things? The truth of the matter is hardly as simple as that. The child's notion of his own personality is acquired on a double basis, from his experience with others and from his experience with himself. We cannot consider either of these two types of experience as first in time or in importance.

Throughout the growth of a person's knowledge of himself, such knowledge continues to have this double basis. Just as we are continually interpreting others in terms of what we know about ourselves, so we are continually interpreting ourselves in terms of what we know about others.

Impulsive behavior is least representative of total personality. — As we have said, one's ordinary actions give little indication of the total personality. Of all types of behavior, that which we call *impulsive* tells us least about the whole man. Impulsive acts are not prepared for by processes of thought. Do we not, as a matter of fact, often speak of them as "thoughtless"? Such acts are performed on the spur of the moment without being fitted into our ultimate desires, purposes, and ambitions.

We do not wish to infer for a moment, of course, that impulsive, thoughtless behavior is always to be regretted. In our discussion of reasoning we pointed out how inefficient a person would be if he stopped to engage in elaborate processes of thought in connection with every act. We simply want to point out here that impulsive actions are more independent of the total personality than are actions of a thoughtful sort.

Voluntary action is more representative of the total personality. — When, as a result of deliberation and thought, we decide what line of action we are going to follow, that action is likely to be in fair accord with our more permanent habits. When we say that a certain act was performed purposely, we mean that, to a greater or less degree, we considered what the results of the act were likely to be and how the act fitted in with our more permanent ideals. When a man commits a crime, the question is almost always raised as to whether he calmly made up his mind to do as he did. If so, he is likely to receive severer punishment than he would if the act were impulsive and therefore less representative of his whole personality.

Since thoughtfulness is the mark of voluntary deliberation, a natural question arises: What relation does such deliberation bear to the usual processes of reasoning, as we have discussed them? The answer to this question is this: Voluntary deliberation is an instance of reasoning, but not all instances of reasoning are instances of voluntary deliberation. In voluntary deliberation, as in other reasoning, there is an attempt to solve a problem by means of ideas. The problem, however, is an intimate and personal one, and the ideas involved in its solution touch upon ideals, ambitions, and other more vital elements of personality. In this, voluntary deliberation is different from many other types of reasoning. It is possible to reason about problems remote from the issues of personal conduct, but voluntary deliberation is always reasoning of this personal sort.

These considerations throw light upon the meaning of what we usually call *will power*. The will is nothing more nor less than a man's total personality, in so far as it is represented in his conduct. If a man is continually performing acts which he regrets at a later time, when he has

leisure for thought, we say that he has a weak will. If, on the other hand, he seldom acts in a way which is out of accord with his larger ideals and life ambitions, we say that he has a strong will. Therefore, will is not something which operates independently of our habitual ways of acting, thinking, and feeling. Will consists of our more permanent habits and their organization, in so far as these affect behavior.

Is behavior ever involuntary? — Sometimes we say that behavior is impulsive, that it is uncontrolled by the more permanent and more typical elements of personality. Sometimes we say that behavior is voluntary, that it is controlled and purposive. On still other occasions we say that behavior is involuntary, meaning that it is directly opposed to one's conscious desires. Involuntary behavior differs from impulsive behavior. Although impulsive behavior may not be in harmony with our truest interests, we do not realize at the time of performing an impulsive act, that it violates those standards most typical of the whole personality. In the case of involuntary behavior, however, we do realize clearly that we are acting out of accord with our complete self.

Behavior is often involuntary because of some factor in the individual's surroundings the influence of which cannot be escaped. The man who is led away to prison goes against his will. He is perfectly aware that he has no desire to go, and also that he is unlikely ever to be glad that he went. Yet he goes, because he realizes that physical force will immediately be applied to him if he does not. Occasionally one of a person's habits or reflexes appears in action despite strong conscious opposition. The drug habit which a man has acquired may be fully recognized by him as out of line with all his other interests and tastes. Yet the habit may possess such strength that he cannot hold it in check, no

matter how clearly he realizes that he is acting in a way he will later regret.

B. The Organization of Sound Personality

Healthy personality has properly balanced habit systems. — There exist in every human personality many habit systems which must operate in harmony. If they do not, there is likely to be trouble ahead. A spoiled child forms habits of constantly expecting the first consideration. These habits may work successfully enough within the family circle, but they do not correspond with the kind of habits necessary for success outside the family circle. And even though the spoiled child forms effective habits applicable to extra-family situations, if the habits of expecting first consideration and the like are still allowed to operate within the family, there is a strong possibility of their cropping out where they should not and interfering with more effective behavior. A man who is habitually ill-mannered and thoughtless during working hours finds it extremely difficult to maintain habits of kindliness and thoughtfulness at home. The work-a-day habit system is almost sure to interfere with the formation of a contrary or opposed system applicable to the home.

The necessity is apparent of considering each habit system not only in and for itself, but also in its relation to other habit systems. The fact is well known that few people can draw a high salary for very long without modifying to an important extent their habits of spending money. Now, there is scarcely anyone who would hold that a man making ten thousand dollars a year should not spend more than a man making four thousand. That is to say, there is no intrinsic sin about becoming a more liberal spender as one's income is increased. Such a habit system as that of money spending cannot, however, be evaluated in and for itself.

There are many lawyers who have had a lifelong ambition to become judges, but financial successes that came to them early in their careers built up standards of living, systems of spending habits, which now make it impossible for them to fulfill their ambition. The lower salary of the judge would make it necessary for them to change their spending habits too radically. As a consequence they find it easier to break the habits of thought and anticipation which constitute the desire to go upon the bench.

Another relevant case is that of a woman who early in life developed skill both in the writing of fiction and in scientific investigation. But the time came when she felt that she had to choose between these systems of habits. In order to write entertaining fiction she found that she must forget herself and let sheer fancy have free play. She must not be too critical, at least until she had finished her writing and came to revise it, because the critical attitude seemed to impede her thought and suppress originality. Her scientific work, on the other hand, seemed to require an almost opposite frame of mind. She must be critical of each step in her thinking and she must keep close to the facts. As long as she tried to keep both sets or systems of habits and attempted to cultivate them by means of frequent practice, she found them interfering with each other. The critical attitude from among her scientific habits was constantly interfering when she tried to write fiction or else was failing to appear with necessary rigor during scientific thinking. Finally she decided to neglect her literary skill in favor of the scientific. But the important point for us is not which system of habits she chose to favor and which she chose to neglect. Our interest is in the fact that one of the two systems apparently had to be sacrificed if the other were to operate at maximum efficiency.

Professor James has described this incompatibility of certain habit systems in his inimitably picturesque language. "Not that I would not, if I could, be both handsome and fat and well dressed, and a great athlete, and make a million a year, be a wit, a *bon-vivant*, and a lady-killer, as well as a philosopher; a philanthropist, statesman, warrior, and African explorer, as well as a 'tone-poet' and saint. But the thing is simply impossible. The millionaire's work would run counter to the saint's; the *bon-vivant* and the philanthropist would trip each other up; the philosopher and the lady-killer could not well keep house in the same tenement of clay. Such different characters may conceivably at the outset of life be alike *possible* to a man. But to make any one of them actual, the rest must more or less be suppressed."[1]

Personality usually has as a basis a small number of major interests and purposes. — To say that there can be in one personality only a limited number of dominant habit systems is to say that one life can be pursued with only a limited number of major interests and purposes. Otherwise the possessor of the personality becomes disorderly and shiftless in his living, and gets nowhere.

A careful distinction needs to be made between the man who is broad in his interests and the man who is dominated by too many purposes. The man who has broad interests has built up a variety of habit systems which pertain to industry, politics, sport, art, and the like, but all of these fit into a larger organization of habits which represents his dominant interest and purpose in life. Some of them add directly to the effectiveness of his main life purpose. For instance, knowledge in the fields of industry and politics is essential if one's dominant purpose lies in the direction of a

[1] *Principles of Psychology*, Vol. I, pp. 309–310 (Henry Holt and Company).

successful career in law. Other habit systems may aid one's main purpose principally by furnishing recreation which makes the pursuit of the main purpose more tolerable.

The man who is dominated by too many purposes, on the other hand, is sure to have habit systems which seriously interfere with each other. A certain man of considerable brilliance has failed to attain success commensurate with his early promise for the reason that no one strong purpose has dominated his personality. He happens to be in banking, but his thoughts of the future dwell as frequently on the possibility of a shift to a career in law, diplomacy, or letters as they do on what he may expect to achieve along the lines of his present work. Since he has so many purposes, his efforts lack vigor and co-ordination. Each direction of his interest seems to take away something from the others. Such a personality is far different from that of the man who, although he has many interests, has a definite order among those interests.

Another man is keenly interested in scores of different topics. About each of these he has accumulated an astonishing amount of information, owing to his habit of inquiring into every matter with which he comes in contact. So well informed is he that he can talk intelligently about almost anything, from stocks and bonds to methods of shoeing horses or mixing paints. But, in spite of the breadth of his interests, he is not what one would call a successful man. Now, his lack of success is by no means owing to the mere fact that he has many interests. It is the result, rather of the fact that, among all these sets of habits that he has formed, one set is just about as strong as the next one. Consequently his efforts do not keep him working long enough in one direction to accomplish anything of importance. He is a ship without a rudder.

Actual incompetence is sometimes the result of lack of dominating interests. — Most of us have a few harmonious habit systems that dominate our personalities. One of these is likely to pertain to our profession or business, another to our home, and another to a recreational activity, such as some form of art, sport, or travel. With strong interests in home, work, and one or more other matters, a person has the best sort of guarantee against useless worry, restlessness, and discontent. Without such interests, on the other hand, severe disturbances of personality frequently result.

Worry, irritability, discontent, and actual sickness are often found in women whose wealth relieves them of household cares, unless some new interest develops to give balance and direction to their lives. And this new interest, whether it be in church work, charity, sport, art, science, or merely in "social climbing," needs to be powerful and whole-hearted if it is to give balance to the personality. The new line of activity which is entered upon must be capable of sustaining more than a passing interest. It must be capable of getting such a hold on the woman that she will not have time or energy left for wanting to do something else or for wanting to go somewhere else. It must keep her so busy that she will disregard the trivial changes that take place in her own health. The statement is often made that poor, hard-working women do not have time to be sick. There is something to this. The too ample leisure that wealth creates, unless there be new and wholesome interests to replace the former ones, gives opportunity for worrying over one's health. And continuous worry over health is one of the best ways in the world for making of oneself a chronic invalid.

Incompetence is sometimes the result of too few interests.— Only the other day I learned of a man who owes his happiness

to the fact that he had a strong system of recreational habits as well as a strong system pertaining to his profession. In boyhood he had built up an interest in moths and had begun a collection of them. After he had grown up and entered upon a business career he did not let this interest lapse. Since the moth collecting could be carried on as a recreational activity, there was no conflict between this habit system and that pertaining to his business life. Consequently nothing was lost by this simultaneous cultivation of both sets of habits. A few years ago this gentleman became seriously sick. When he had partially recovered he was told by his physician that, as he had saved enough on which to live, it would be better for him to retire from business and devote the remainder of his life to less strenuous affairs. And right here is where his interest in moths saved him much unhappiness. The habits making up this interest were strong enough to keep him busy and to enable him to forget himself. Many men, lacking some keen interest of this kind, would have found retirement a state of misery. They would have had too much time to pity themselves. Consequently, what reserve of health they possessed might easily have been lost as a result of the very bad influence of a gloomy state of mind.

Even though most of us never have to fall back upon some recreational activity as our chief life interest, there are other dangers that confront the person whose entire life is dominated by a single habit system. We are all familiar with men who have no dominating interest except that which has to do with their business. Home is a place where they talk over the day's happenings in the office or the morrow's business prospects, and where they rest merely in order to fit themselves for further working. The only friends who interest them are business friends. The only current news to which

they pay attention is that which throws light upon business prosperity. Men of this variety, unlike those earlier mentioned, with many interests but no dominant one, are likely to be successful in a certain sense. They are likely to make money and to develop the size and prestige of their business. They are likely to enjoy the lives they lead and to be too busy to indulge in aimless worry and discontent. Their lives are likely to be orderly and, of course, they have no lack of aim. Their personalities, however, suffer from the fact that they are narrow.

Successful living demands the guidance which some one strong interest or habit system can furnish, and perhaps no one interest is more worthy of determining the direction of our lives than interest in our life work. Nevertheless, it does not follow from this that there is wisdom in protecting our dominant interest from interference by failing to cultivate *any* other interests. We have obligations to meet as citizens and as members of a family; we have opportunities for a fuller life than any one set of interests can give. There is, therefore, a real reason for us to cultivate more than one strong habit system. A powerful interest in politics, art, sport, or even a powerful interest in one's family and the affairs of its members may, it is true, interfere from time to time with the pursuit of one's profession, but one cannot expect to avoid all such interferences. In the long run it is better to have a certain amount of competition among one's interests, so long as that competition does not have really serious effects, than to have one's life entirely dominated by a single, narrow interest.

Personality may be organized around almost any habit systems or interests. — There is practically no limit to the kinds of habits and systems of habits which can be incorporated into a human personality. There is likewise hardly

any limit to the habit systems which may dominate personalities. This is clear when we consider that there are no two individuals in this world who are exactly alike.

There is probably not a single phase of life which is not or has not been a dominant interest for some person or group of persons. The building of bridges, ships, locomotives, telephone lines, each represents a type of activity that has been the chief and guiding interest in the lives of thousands of men. Every religious creed, every art, every field of human knowledge has at some time or other been the central element in the life of some individual. Every vice and every virtue, every trait demonstrated in human character has the capacity of becoming the dominant interest in someone's life. Personalities have been ruled by the love of gold, by the love of food and drink, by an irresistible passion for lies and deceit, as well as by charity, temperance, and a passion for justice and honesty.

The prevalence of these various interests, the values attached to them, and their prominence as cornerstones of personality differ greatly, of course, among different groups of people and at different periods of history. Interest in business is the major interest in a relatively great percentage of citizens of the United States of America in this twentieth century. Among the Indians, especially before the white man came, war and the hunt were the big facts of life for the vast majority. At one time in ancient Athens, art and sport were principal interests of men of the upper class.

Personality depends upon our surroundings. — It is not strange that the American boy of today should so naturally find his chief interest and ambition leading him toward a business career. Except in those rare times of actual war, military glory is made little of by the American people.

Art, scholarship, agriculture, medicine, and other worthy pursuits are held in high esteem, but business offers the greatest opportunities for money making, and money, these days, seems the most tangible reward that ability and endeavor can command. The same boy, if he had been born at another time and in another place, would have found his personality becoming organized around quite other dominant interests. Suppose that he had been born in a community where business and trade were held in low esteem and where warlike achievements brought the greatest honors and rewards. Is it not likely that he would have found thoughts of battle and plans for a military career the most potent factors in his life?

Not only the objects of our principal interests and the purposes around which our habits of action, thought, and feeling are developed, but also the detailed nature of our personalities is determined to a remarkable degree by our surroundings. The boy who is directed by the example of his elders toward military ambitions will develop attitudes toward bravery, toward physical suffering, toward obedience, quite different from those which would be developed in the same boy if his principal ambition had been for business success. In the truest sense he would not be the same boy at all.

Many varieties of personality develop even in a single community. — Our general surroundings, the country, the period in which we live, favor the development of personality along certain lines. They may favor our being more interested in business than in poetry. They may favor our being more interested in justice than in personal gain. Nevertheless, no two of us develop personalities that are exactly alike. No matter how commercial the spirit of a community may be, now and then there will occur some

individuals whose lives are centered around an interest in poetry. No matter how high the moral standards of a community may be, there will occur some individuals whose ruling habits are immoral.

Since each personality within a single town, and even within a single family, may develop in any one of many directions, we well may look upon our own development as largely in our own hands. Within wide limits we may choose our life work, our friends, our moral code, our reading. If we but learn to look at ourselves frankly and consider ourselves thoroughly our own masters, we may govern our own personal growth as no one else could.

No one can tell anyone else exactly how his personality should be built up, just what habit systems should be included in it, and just what amounts of emphasis should be placed upon this interest and upon that. The world needs farmers and mechanics as well as statesmen and surgeons; and vigorous, prompt-acting men as well as others of calmer habits. Who shall play each of the many rôles which the life of society demands cannot be decided in any cut-and-dried manner. Within wide limits, as we have already said, each individual who will may choose for himself. Still, there are some general facts concerning the selection of dominant interests to which we all may well pay attention. We shall, as our next step, inquire into the nature of a number of these facts.

Our guiding interests should be in reality. — Those personalities that are soundest and most capable of standing up stanchly and bravely in the face of the stresses and strains of actual life are personalities whose dominating interests are in the world of reality. Thinking, planning, dreaming along the lines of our principal ambitions are natural. The greatest achievements of mankind are first worked out in

thought. But, as we said in our chapter on imagination, thought is not in itself a worthy end. Thought needs to be based upon reality and to be expressed from time to time in actions of genuine consequence.

If one's personality is dominated by interests which, by the very nature of the case, can have no bearing upon the real business of living, one's accomplishments are not likely to be important. One cannot identify himself completely with matters that have no counterpart in the world in which his actual living must be done and still remain a happy and efficient citizen. The personality of Miniver Cheevy, so brilliantly described in the poem by Edwin Arlington Robinson, is a sick personality because ruled by ideals and interests which are out of touch with the actual world.

Miniver Cheevy, child of scorn,
  Grew lean while he assailed the seasons;
He wept that he was ever born,
  And he had reasons.

Miniver loved the days of old
  When swords were bright and steeds were prancing;
The vision of a warrior bold
  Would set him dancing.

Miniver sighed for what was not,
  And dreamed, and rested from his labors;
He dreamed of Thebes and Camelot,
  And Priam's neighbors.

Miniver mourned the ripe renown
  That made so many a name so fragrant;
He mourned Romance, now on the town,
  And Art, a vagrant.

Miniver loved the Medici,
  Albeit he had never seen one;
He would have sinned incessantly
  Could he have been one.

Miniver cursed the commonplace
And eyed a khaki suit with loathing;
He missed the mediaeval grace
Of iron clothing.

Miniver scorned the gold he sought
But sore annoyed was he without it;
Miniver thought, and thought, and thought,
And thought about it.

Miniver Cheevy, born too late,
Scratched his head and kept on thinking;
Miniver coughed, and called it fate,
And kept on drinking.[1]

Within us all there occasionally arise longings for adventure, for romance, for luxury which the seemingly humdrum course of everyday life cannot supply. The well-organized personality satisfies these longings in art, literature, and the "castles in Spain" which his own imagination devises. But there are those in whom these longings, which are not susceptible to satisfaction in actual life, become, as for Miniver Cheevy, ruling interests. When this occurs one may take refuge in his dreams from the problems which he should be trying energetically to solve. Or he may become a discontented seeker after those things which real life cannot give him. Dickens' Mr. Micawber became so engrossed in the idea of having fortune fall into his lap some day, that he gave up the effort to better his situation by any such practical and prosaic plan as setting to work. All of us are familiar with those who imitate the dress and manners of the wealthy as if that would really give them the things they long for. The shop girl and the school girl who don silks and gaudy finery in which to go about their daily tasks are plainly getting their dreams mixed with reality.

[1] Reprinted by special arrangement from *The Town Down the River* (Scribners).

Guiding interests should harmonize with the community in which we live. — There are times when individuals are needed who can develop ideals and interests contrary to those of the community at large; and there are times when communities derive great benefits from the fact that these so-called radicals express their own peculiar, dominating interests in such a way as to bring them into sharp conflict with the habits of mind of the majority. Long before there were any real signs of prohibition going into effect, there were occasional persons whose lives were ruled by a savage hatred for alcoholic beverages and for everything connected with them. There is no doubt that these radical persons were influential in altering the attitude of the public at large toward alcohol. Probably no great change ever occurs in public ideals without some radicals — some persons dominated by ideals contrary to the prevalent ones of their time — playing a part in the change.

But it is one matter to discuss the radical in terms of the part he often plays in public progress (of course, as often as not his peculiarities are no more representative of progress than of the reverse), and quite another matter to discuss radicalism as a trait of personality. It is quite possible to show that those afflicted with grave mental disorders may play a useful part in the life of society, but if you were intrusted with the training of a child you would hardly choose to produce a queer adult, dominated by strange ideas. You would not choose to do this even though you are aware that his very queerness might make him useful from a social point of view. Great poems, great religious ideas, great deeds have at times come from minds which were perilously near insanity, if not actually in that state. Yet few of us would wish to be insane or even to be cranks for the sake of some marvelous contribution to society which we might,

but in all probability would not, make by virtue of our peculiarity.

One may have a healthy, well-organized personality without giving in to custom and majority opinion at every turn. One may have ideals that depart from those most common among one's contemporaries without coming into constant conflict with those contemporaries. But in order for this to be true it is necessary that one have, along with the interests and ideas which dominate his own life, some appreciation of the interests and ideals of others. It is necessary for him, in some degree at least, to be able to put himself into the other fellow's shoes. This is what the crank is unable to do. He can see no point of view other than his own. He thinks that the rest of the population is made up of fools or miscreants and he acts toward them accordingly. As a consequence, he is likely to be avoided, laughed at, and at times treated with cruel injustice, no matter what the ultimate value of his ideas may be. And this treatment typically leads him to become more and more bitter and intolerant toward those among whom he is forced to live. It is true that the crank, by virtue of this fact that he has such a narrow vision, is often willing to sacrifice everything for his own notions. And occasionally, as we have said, great accomplishment results. Nevertheless, the crank is out of tune with the world and furnishes a poor model of personal organization.

Although great things are sometimes done by persons who are out of sympathy with the ideas and interests of those with whom they live, the mere fact that one is queer furnishes, as we have said, no guarantee of such accomplishment. Furthermore, the fact that one is so organized that he is able to get on with his fellows and to take a sympathetic view of their ideas, even when he does not agree with them, is no

reason why he should not make important and original contributions to the welfare and happiness of society. From all we know of William Shakespeare's more productive years, they were spent as a well-balanced individual might expect to spend them. Apparently his plays were written to please the theater-going public and not to reform it. And the fact that, when produced, the plays were well attended and financially successful indicates that, with all his great ability and originality, he understood and sympathized with public taste. Shakespeare, if we may judge from the historical records of his career, was an up-to-date, successful citizen. He knew what people wanted, he gave it to them, and in return he received liberal rewards in the form of both admiration and money. Nor is there any reason to believe that his genius was less because it was in harmony with the spirit of his time.

We should learn to see ourselves as others see us.—There is a strong tendency in each of us to consider that our own interests designate what are really the most important things in life. If we like painting, we assume that painting is the finest form of art. If we are business men, we assume that other than business affairs have a merely superficial value. If we are scholars, we assume that no human accomplishments are quite so praiseworthy as those of learning. When such assumptions are made just as we have stated them, without due allowance for our personal bias, they mark a certain defect in personal organization.

> O wad some power the giftie gie us
> To see oursels as others see us!
> It wad frae monie a blunder free us
> And foolish notion.

Now this ability occasionally to look upon our own opinions and interests from other people's points of view

is as important as understanding what are the ruling factors in the lives of others. If I am constantly coming into conflict with my fellows I cannot for long maintain a calm, stable, healthy personality. And the avoidance of such conflict depends quite as much upon understanding what others think of me and my interests as it does upon my understanding of their interests.

There are few elements of personality that better indicate good or poor personal organization than one's sense of humor. To be able to see a joke on oneself, to be able to see the humorous aspects of one's own character, these are great assets when it comes to standing up under the stresses and strains of life. The minister who can see a funny side to the fact that his occupation is supposed automatically to make him sinless is much more likely to get on well with himself and with his layman fellows than the minister who takes himself too seriously. If the scholar, interested in some remote corner of knowledge, can appreciate and actually enjoy the ridiculousness of his occupation as viewed through the eyes of the average man, he is hardly likely to feel himself cut off from society because of the peculiarity of his interests. An important fact about this ability to see a joke on oneself is that it indicates a larger ability to see oneself, not only from one's own necessarily prejudiced point of view, but also from the point of view of others. The ability to smile at one's own peculiarities means that one has that much poise and self-control.

Our guiding interests should be in definite accomplishments. — Several years ago one of the greatest Americans of his time attended a meeting of a small group of men who were studying for the ministry. During the course of the meeting the great man was called upon to say a few words to this group of earnest students. The essential message which

he delivered to them was summed up in one brief sentence. "*There is nothing in all the world so priggish as the cultivation of character.*"

Now what did he mean by this? Surely he did not mean that honesty, courage, kindliness, and the whole list of virtues were worthless, nor did he mean that these virtues could be cultivated only in a spirit of conceit. What he did mean is plainly this, that the finer qualities of character can be cultivated successfully only indirectly through concrete achievements. Courage in the abstract is less important than the definite situations in which one can learn to act courageously. One can learn to endure physical suffering, to speak the truth where the truth needs to be spoken, to stand up bravely under criticism, and under many other circumstances to act courageously, but any attempt to cultivate courage apart from specific habits of action, thought, and feeling is almost sure to fail.

It is astonishing how many personalities are lacking in forcefulness precisely because of the vague indefiniteness of their ruling interests. Many a man, dominated by a desire for wealth or fame, is hopelessly lacking in ideas regarding the concrete business of carrying out his desires. If he were primarily interested in banking or politics and only secondarily interested in wealth or fame, his chances of acquiring the latter would be considerably enhanced. Of course, it is well for a man to know toward what distant goal he is working, but interest in a distant goal will seldom keep one expending his best efforts day in and day out over a long period of time. There needs to be a strong interest in the work as well as in the hoped-for outcome. Wealth and fame are matters of a far-away and indefinite future which, for most of us, will never actually arrive. If our main interest in life is in those things, the concrete achievements

of everyday life are likely to seem dull and trivial. As a consequence our efforts are prone to flag and we may come to seek satisfaction in dreaming rather than in doing. The concrete actualities of daily work are, however, close to all of us. If we can but find a strong interest in them, there will be little doubt of our staying on the track, of our putting our best into our jobs.

We should try to understand our own motives and interests. — Suppose we ask a woman why she attends the opera. It is fairly certain, is it not, that she will tell us of her great love of music. Almost everyone knows that such an answer may or may not be true. If it is not true, we are by no means justified in saying that the woman has tried to deceive us. It is quite possible that she would never attend the opera if fashion had not made it *the correct thinq to do.* But in that case she may be totally unaware of why she goes to the opera. She may sincerely think that she is a thorough music lover. In the chapter on reasoning we said that a statement that sounds well is very likely to be accepted as true. Especially is this so if the statement is not easily checked up in some way. Nowhere do we find this acceptance of the high-sounding explanation so ready as in the case of our own actions. And here, too, a strong reason for its acceptance lies in the fact that it is not easily checked. Let us suppose that fashion is the strongest factor in making the woman we have questioned attend the opera. The woman has never had an opportunity to go to a musically meritorious, but unfashionable opera. If she had, she might have come to realize that music meant less to her than style, but, since she has not, she is perfectly willing to give the best reason she can think of as *her* reason for attending the opera. This business of making up a high-sounding explanation of one's own actions and accepting it without criticism is

indulged in to some extent by everybody. Psychologists call it *rationalizing.*

The universal tendency to rationalize is one thing that makes it rather difficult for people to understand themselves. Since the vast majority of people are not even aware of the prevalence of the tendency, they go on fooling themselves without making an attempt to get at their real motives.

Sometimes our motives for acting as we do lie beyond the possibility of immediate discovery and can be got at only by a long-continued study of ourselves. I know a man who has an antagonistic attitude toward those who have had more education than he has had. He can enumerate a long list of faults which he firmly believes most college men possess. He also believes that it is because they have these faults that he is prejudiced against men with college training. To be thoroughly accounted for, however, this prejudice would have to be traced back to factors in his own life. Many of these he may have forgotten, or, if he has not forgotten them, it is unlikely that he could see any relationship between them and his antagonism toward college men. He may at one time have wanted very much to go to college and perhaps he was disappointed. Under these conditions a person will often get over his disappointment by the "sour-grapes method"—by telling himself that college breeds more conceit than learning, that college men become impractical, and so on.

In other cases the real motives that underlie our rationalizing are more easily discovered. If I come upon a hard problem in connection with my work, I can think of a dozen fine-sounding excuses for putting off its solution. I can think of all the physical benefit to be derived from a half day in the country. I can think of a dozen reasons why I should take my mind off this troublesome affair until my head is clearer, and so on, and so on. And yet, if I but pause a

moment to be honest with myself, I can scarcely help seeing that my real motive is a desire to get away from a difficult task which I shall be no better prepared to solve later than I am now.

In order to understand ourselves then — and self-control can scarcely be gained without such understanding — we must no more be deceived by the false arguments that we concoct than by those concocted by others.

> This above all: to thine own self be true,
> And it must follow as the night the day,
> Thou canst not then be false to any man.

Summary of the Chapter

1. An individual consists of all his habits and also of the organization of these habits.

2. We cannot discover from one act of behavior the nature of the personality behind that act. Only a prolonged study of a person, in which we get acquainted with his ideas, can give us a notion of the total man. Considerable experience is required even as a basis for understanding one's own personality.

3. Our behavior is sometimes more representative of our total personality than at other times. Impulsive, thoughtless behavior is least representative of the whole man. Voluntary behavior is most representative of the whole man. There are, of course, some occasions upon which behavior is in direct violation of what one knows to be his real personality. Such is the nature of what we call involuntary behavior.

4. In a healthy personality the various habits and systems of habits must be properly balanced. Not all kinds of habits will go together successfully.

5. It is necessary for a person to be more or less dominated

by a small number of interests. This does not mean that there is a disadvantage in being interested in many things, but merely that it is necessary for a few interests to dominate the rest. Otherwise one's life lacks purpose and plan.

6. Almost any habit systems or lines of interest are capable of dominating a personality. What interests are most frequently found dominating persons varies from time to time and from community to community. Even at the same time and in the same community we find considerable variety in the factors dominating different people.

7. It would be unwise to try to dictate in the case of every child just what shall be the principal interest around which his personality should be organized. There are nevertheless certain general rules about the selection of such interests which may well be kept in mind.

a. Guiding interests should be in the world of reality rather than in a fictitious world arranged to suit one's fancy.

b. Guiding interests should fit in reasonably well with the community in which we live. Even if we cannot support the main beliefs and interests of that community, we shall get on much better if we at least make an effort to understand why the ideas of those around us are not the same as ours.

c. We should learn to see ourselves from the other fellow's point of view. This does not mean giving up our own interests, but merely learning to realize how we must seem to a person whose interests are other than our own.

d. Guiding interests should be in definite accomplishments rather than in the cultivation of abstract traits of character or in the reaching of remote and improbable goals. It is wise to hitch our wagon to a star only if we are willing to forget the star's pulling

power and to depend largely upon the pushing power which we can exert upon our wagon from behind.

e. We should seek knowledge about what our dominant interests really are. The fact that we have dominant interests does not mean that we even half understand them. Yet such understanding is necessary for the attainment of self-control.

PROBLEMS

1. What points in the summary deal with the first of the questions raised at the beginning of the chapter? With the second?

2. Write a description of the personality of someone whom you know very well. (It will be better not to give his name.) Show how your knowledge of this person is based upon his ideas as well as upon his behavior. Show also how your knowledge of your own personality has helped you to understand this individual.

3. Tell how your knowledge of your own personality has been aided by what you know of other people.

4. Describe an instance of voluntary behavior, of impulsive behavior, of involuntary behavior. Discuss the degree to which the whole personality is represented in each case.

5. No personality is perfect. What steps might you take to make yourself a more effective individual?

REFERENCES FOR FURTHER STUDY

James, *Psychology, Briefer Course*, pp. 176–181; or *Readings in General Psychology*, Ch. XX, Selection 3-A, p. 527 ff.

Washburn, in *Studies in Psychology*, (in honor of Professor Titchener), pp. 11–17; or *Readings*, Ch. XX, Selection 5-A, p. 539 ff.

Herrick, *Journal of Comparative Neurology and Psychology*, 1904, pp. 120–123; or *Readings*, Ch. XX, Selection 5-B, p. 545 ff.

Hart, *The Psychology of Insanity* (3d. ed.), pp. 40–52; or *Readings*, Ch. XX, Selection 7, p. 551 ff.

Cory, *Psychological Review*, 1919, pp. 397–406; or *Readings*, Ch. XX, Selection 8-A, p. 555 ff.

Cory, *Journal of Abnormal Psychology*, 1919, pp. 281–285; or *Readings*, Ch. XX, Selection 8-B, p. 563 ff.

Wells, *Mental Adjustments*, pp. 11–12; or *Readings*, Ch. XIX, Selection 10, p. 518 f.

CHAPTER XV

ABILITIES AND THEIR MEASUREMENTS

A. How Abilities Are Measured

B. Measurement of Simple and Complex Abilities

C. Measurement of General Abilities

D. Testing the Value of Measurements

Questions to Keep in Mind while Reading this Chapter

1. How can abilities be measured?
2. How are high, medium, and low abilities distributed among people in general?
3. What are complex abilities, and how are they measured?
4. What are general abilities, and how are they measured?

Abilities are elements of personality.--What an individual is and how well he is able to face the trials of life depend, as we have seen, upon what habits he has formed and the manner in which those habits are organized. But in order to know an individual well we must do more than ask ourselves what habits he has formed and how those habits are organized. We must also ask ourselves at what level of efficiency his various habits are capable of operating. There is some value in knowing that a man is interested in politics, but there is more value in knowing how expert his judgment is in this field; there is some value in knowing that a man sells life insurance for a living, but there is more value in knowing just how good a salesman he is; there is some value in knowing that a man plays tennis, but there is more value in knowing how well he plays that game. Thus,

in the study of individuality we should give considerable attention to differences in the efficiency of people's habits and to the methods by means of which we measure such efficiency.

The efficiency of any of an individual's many habits can be considered. A habit considered in regard to the level of efficiency at which it operates, is usually spoken of as an *ability*.

A. How Abilities Are Measured

Abilities, like physical traits, are subject to measurement. — Whenever we wish to describe such a physical trait as height, we do so in terms of quantity. We say that John is six feet, one and one-half inches tall, or, if we lack precise information, that John is a little taller than his father and a little shorter than his older brother. In either case we have described John's height in terms of quantity, though it is of course apparent that the description in terms of inches is considerably more exact than the rough comparison between John's height and the heights of two other people. Weight and diameter of skull are other traits which are capable of being measured and described in fairly exact, quantitative terms.

It is also possible to measure and describe quantitatively many of the *abilities* which individuals possess. By means of the proper instruments we can measure strength of grip, speed of running different distances, and height or distance that can be jumped. In schools, by means of tests and examinations, teachers measure the ability of their pupils to spell, to name the capitals of states, to solve problems in arithmetic and algebra. Business executives keep track of the orders taken by their salesmen so that as accurate measurements as possible can be made of their ability to sell.

Human abilities are often measured in terms of rank order. — As we have shown, even when we lack instruments for exact measurement, it is possible to give a rough quantitative statement of the height of an individual by comparing him with other individuals. We can say of John, for instance, that within that group of persons made up of John, his father, and his older brother, he is in the middle position in respect to height. This method of measurement in terms of rank is often the only one that can be satis-

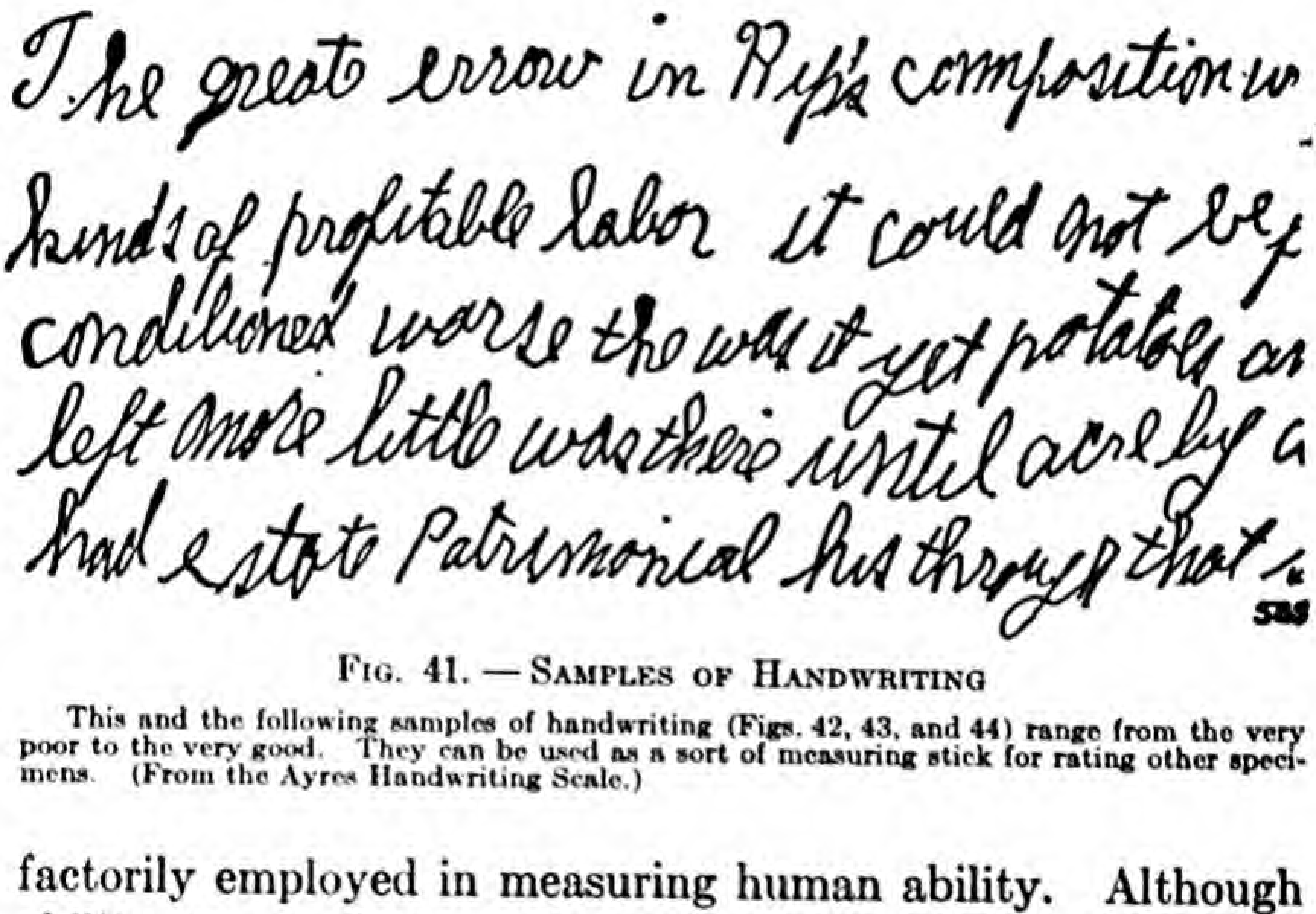


FIG. 41. — SAMPLES OF HANDWRITING

This and the following samples of handwriting (Figs. 42, 43, and 44) range from the very poor to the very good. They can be used as a sort of measuring stick for rating other specimens. (From the Ayres Handwriting Scale.)

factorily employed in measuring human ability. Although ability to run fast can be measured in terms of seconds, ability to jump in terms of feet and inches, and ability to shoot a rifle in terms of the number of times a target of a certain size can be hit from a given distance, there are many human abilities to which these or similar units of measurement cannot be applied. Handwriting is a case in point. About the only practicable way of measuring the quality of a person's handwriting is to compare a fair specimen of it with

specimens from the handwriting of other persons. It is possible from such comparisons to judge about how much

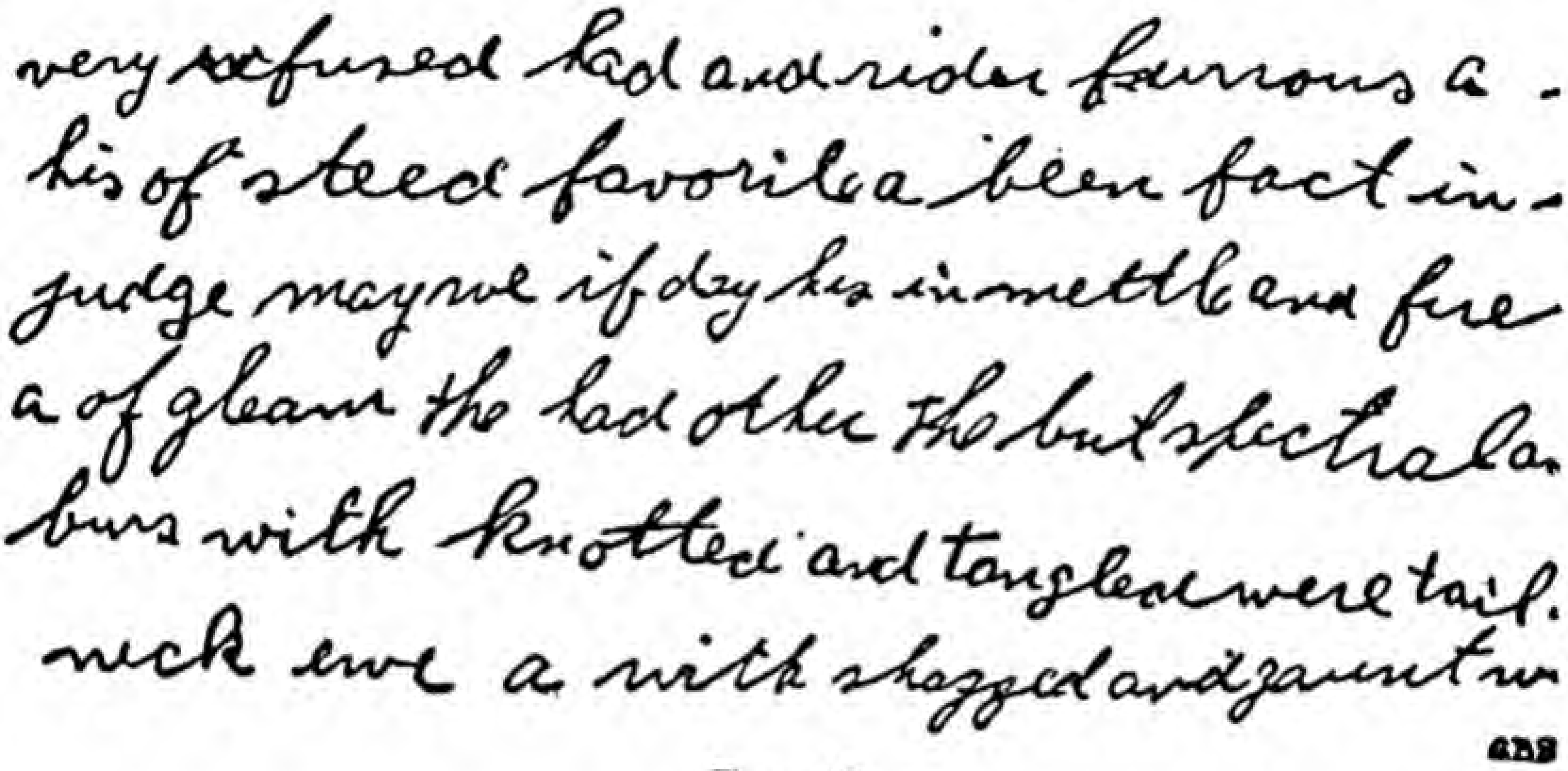


FIG. 42

merit a given specimen of handwriting possesses in terms of where this specimen belongs within a larger group of specimens.

Skill at tennis is another ability which cannot be measured satisfactorily except in terms of rank order. By matching

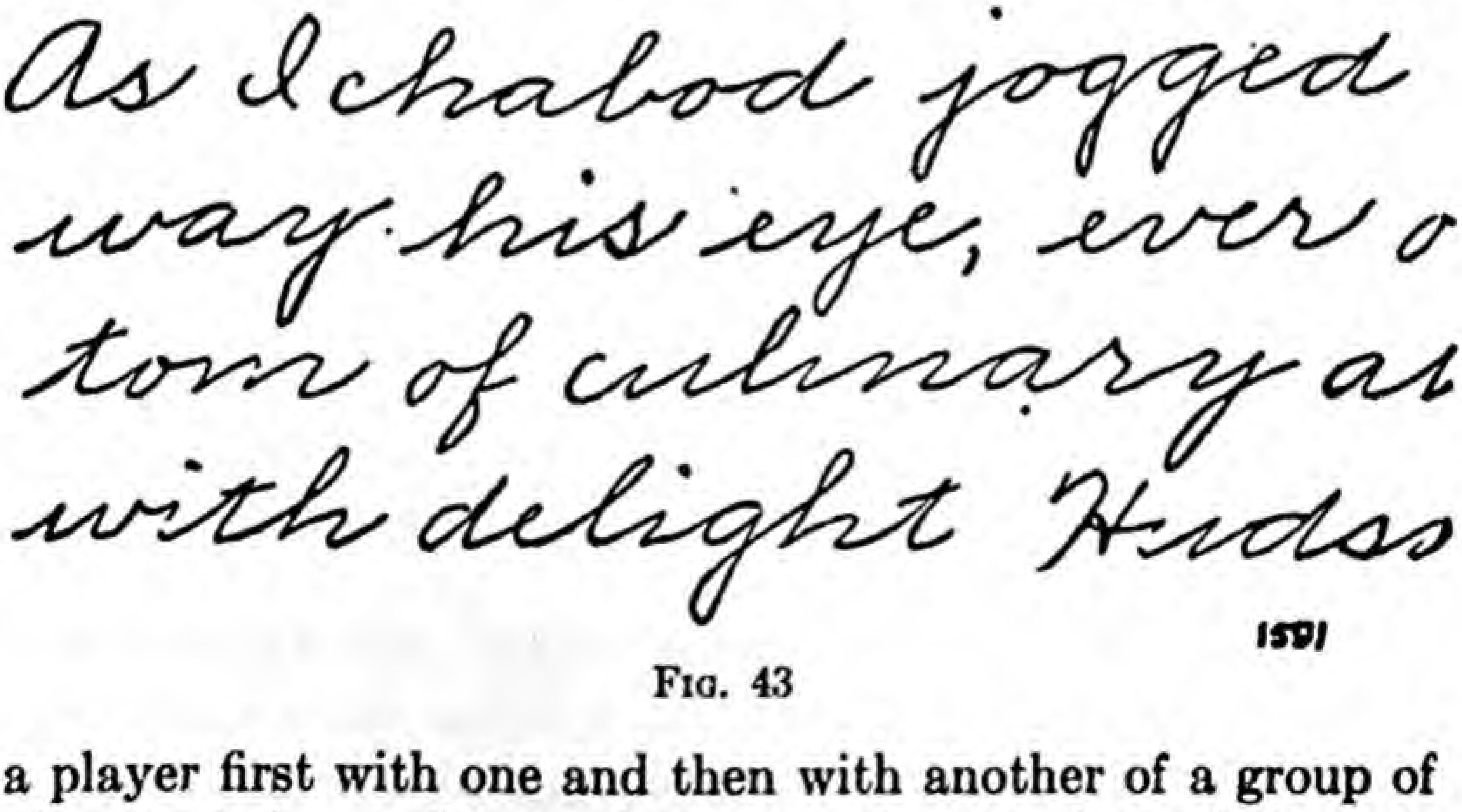


FIG. 43

a player first with one and then with another of a group of players, it is possible to determine the standing of the first

player within the group. We can consider that those whom our player beats have less ability than he, and that those who beat him have more ability than he. If, as a result of nine matches, we discover eight players whom he can defeat and one who can defeat him, we can say that he ranks second in the whole group. The baseball-playing ability of each league team is measured in terms of rank. By means of contests, which are arranged so as to bring all teams into conflict with all other teams in the league an equal number

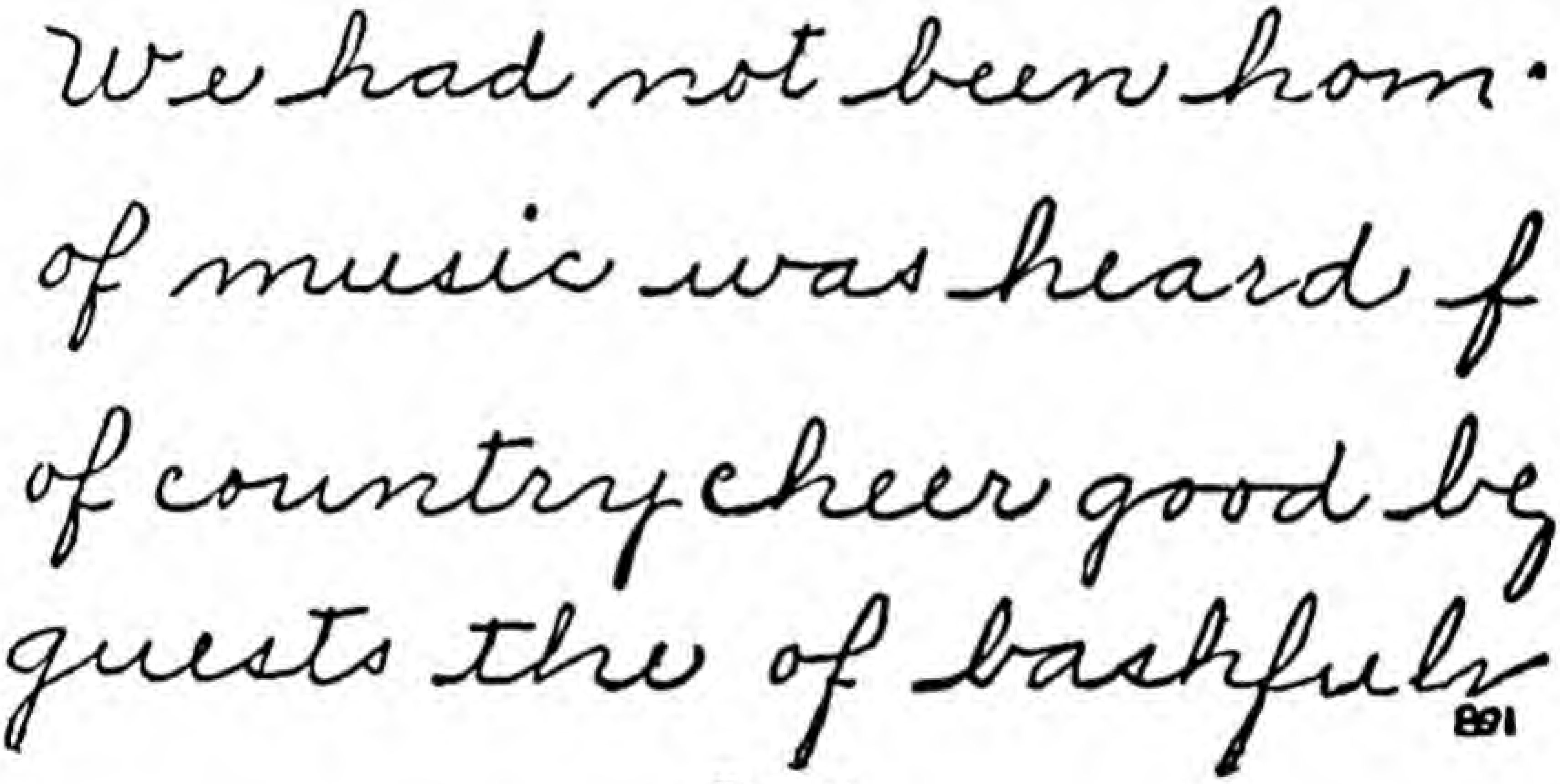


FIG. 44

of times, the abilities of the teams are compared. From these contests the ranks of the teams are arrived at, and these ranks are measurements of their skill. In other words, there is no way of stating, at the end of the season, just how much playing ability is possessed by the Giants, except by comparing them with the teams against whom they have been playing.

All measurements of human ability are based upon comparison of actual individuals. — When we measure the ability of one individual by assigning to him his relative position or rank among other individuals, we have to make

certain direct comparisons among the individuals involved. When we say that John ranks between his father and his older brother in regard to height, we have to compare John directly with each of these other persons. Now there are instances, as we have already said, in which human ability can be measured in terms other than those of rank. We can, for example, measure the speed with which a man can run by timing him over a one-hundred-yard stretch. We can then describe his ability to run by saying that he can do the one-hundred-yard dash in ten seconds. Clearly such a measurement as this does not demand that the speed of the runner in question be brought into comparison with the speed of other runners. It would be perfectly possible to state the rate at which Jones can do the one-hundred-yard dash, even if no other human being had ever run that far before. This stands in marked contrast with the method we use when we measure the merit of handwriting. If no one but Jones had ever written before, it would be totally impossible to determine how well Jones can write.

From our discussion thus far it might seem that measurements in terms of seconds, feet, and the like, which do not demand the direct comparison of individuals with individuals, are vastly superior to those in terms of rank order. A little thought, however, quickly reveals the fact that measurements of human ability in terms other than those of rank are not so much better after all. Let us suppose that we have timed Jones and have discovered that he can run one hundred yards in ten seconds. Do we know from this whether Jones is a fast or a slow runner? Of course, anyone who is familiar with sport knows that this is good time. Nevertheless it is good time only because it is better time than can be made by the vast majority of people. In other words, it is only

because of what we know of other runners that we are able to say that Jones's running ability is of a good order. If we knew nothing about the ability to run possessed by others, Jones's time would not give us any very intelligible information about his ability to run.

Let us suppose that we had tested out Brown's ability to learn poetry by heart and that in that test he had succeeded in memorizing ten stanzas of "The Ancient Mariner" during the thirty minutes allowed him for study. We could state in definite, quantitative terms Brown's ability as a memorizer, but this statement, however definite, would not in itself be especially enlightening. In fact, it would not be nearly so enlightening as a mere statement of Brown's rank as a memorizer among other memorizers. Something would have to be known about the memorizing ability of some other individuals and Brown's achievement would have to be brought into comparison with the achievements of those others before it would really mean anything. Ten stanzas learned in thirty minutes might designate either good or poor memorizing ability. All depends upon how much other persons can memorize during the same length of time.

Thus we see that, even when an ability is of such a kind as to make possible its measurement in seconds, feet, or other similar units, we are never rid of the necessity of interpreting one man's ability in terms of the ability of others. Only to the extent to which comparisons of this kind are made do seconds, for example, become meaningful. The standards in respect to which human abilities are measured must always be based upon abilities as they actually occur in human life. There are no absolute standards of ability that can be applied without reference to real human performances.

Attempt to determine one man's ability without reference to ability possessed by others often leads to false results. — The other day I heard of a teacher of mathematics who had given very low marks to over half of the members of a large class. Not only that, but he was in the habit of giving a large number of low marks year after year. This meant that he considered most of his students very low in mathematical ability. The probability is, however, that he and his methods of marking, rather than his students, were the real source of the difficulty. If his standard of high ability had been taken from the achievements of the better students under his instruction, his standard of average ability from the achievements of the average students under his instruction, and his standard of low ability from the poorer students under his instruction, he could hardly have designated more than half his class as of low ability. Instead of this he had created standards of ability with little or no reference to what students are actually capable of doing. It is very easy also to find teachers who err in the opposite direction. They give high marks to such a large number of their students that *excellence* no longer has any real meaning.

There is a tendency present in most of us to judge human ability in terms of ideal, or even fanciful, standards instead of in terms of standards based upon what people actually can do. If we ask the average physician what are the capacities of a *good* physician, the chances are that he will describe someone whose powers are superior to those of any existing man. Without realizing it he will describe, not the abilities of a good physician, but rather the abilities of an ideal physician. Of course, the strict application of such standards to the flesh-and-blood physicians who actually exist would result in most of them appearing to be of very low ability. But it is not so much their own lack of ability

as it is the false nature of the standard applied to them which puts them in such an unsatisfactory light.

Scales for measuring ability need to be calibrated. — If I knew that Jones were six feet and four inches tall, I still should not know whether he were a tall man or a short man, unless I knew something also about the heights of other men. Six feet and four inches happens to be an extreme height, but the only reason for this is to be found in the fact that a very small percentage of the population is so tall. If most people were even taller, six feet and four inches would designate shortness of stature. Thus it is apparent that the ordinary measuring scale of inches and feet can be applied intelligently to the measurement of height only after the meaning of each point on such a scale has been defined in terms of the statures of actual people. The process of establishing these meanings for different points on the scale is called *calibrating* the scale. Sometimes the whole procedure is spoken of as the establishment of *norms*.

In practice these calibrations or norms are likely to take some such form as the following table, which gives the average height of boys and the average height of girls at different ages. Having such data and knowing the height, age, and sex of a given child, we can say whether it is fair to consider him as tall, short, or approximately average.

NORMS OF HEIGHT IN CENTIMETERS (MODIFIED FROM WHIPPLE AFTER SMEDLEY)

Age	*Average height of boys*	*Average height of girls*
6.0	110.69	109.66
6.5	113.25	112.51
7.0	115.82	115.37
7.5	118.39	118.22
8.0	120.93	120.49
8.5	123.48	122.75
9.0	126.14	125.24
9.5	128.80	127.74
10.0	130.91	130.07

Scales for measuring ability, like scales for measuring such physical characteristics as height, weight, and the like, need to be calibrated in terms of the performance of actual people. Psychologists sometimes record the rate at which a person can tap with a metal point upon a brass plate. Let us suppose that a certain subject, when tested, taps 184 times in 30 seconds. Is his rate of movement rapid or slow? It is evident that we must have more information than that

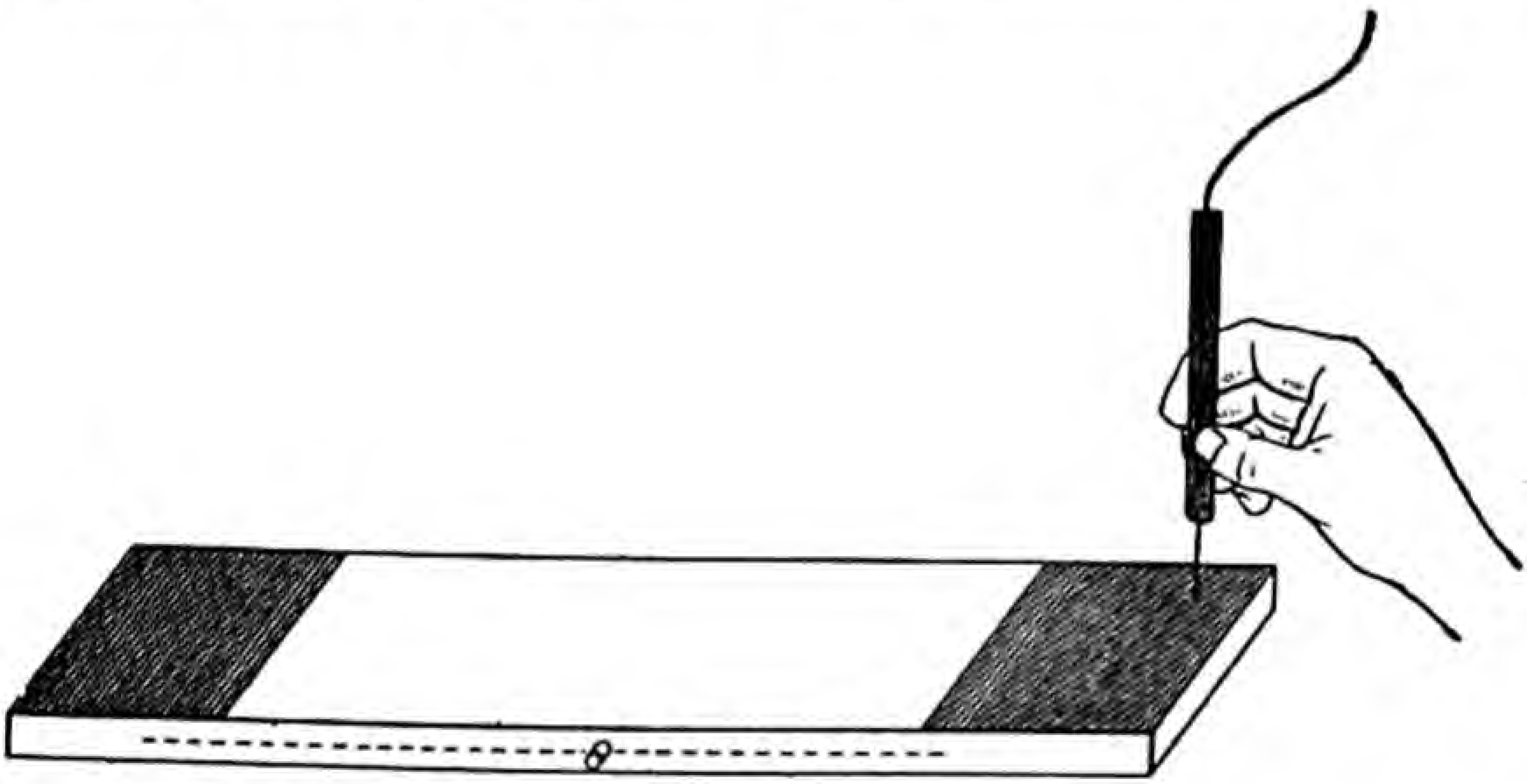


FIG. 45. — TAPPING BOARD

The subject taps as fast as he can with the pointer, and the number of taps is recorded by an electric counter attached to the board.

supplied by the figures themselves before we can answer the question. We must know how fast other persons can tap.

But even that would not give us a reliable basis for judgment unless those other people were of the same general sort as the person tested. If our subject be a boy of thirteen years, his rate of tapping should be interpreted in terms of the rates of other thirteen-year-old boys and not in terms of the tapping rates of girls, or of men, or of boys of ages differing from his. Furthermore, the rates of those other thirteen-year-olds should have been established by the same kind of experi-

ment as that by which his rate was established. If his tapping was performed with his right hand, it should be compared with tapping rates attained by others with the same hand. The accompanying table furnishes a basis for interpreting the meaning of a tapping rate of 184 per 30 seconds in a boy of thirteen years. From it we learn that the subject in question is neither a rapid nor a slow tapper, but one of average speed.

NORMS FOR TAPPING RATE FOR BOYS (MODIFIED FROM WHIPPLE AFTER SMEDLEY)

Age	*Average taps per 30 secs. with right hand*	*Age*	*Average taps per 30 secs. with right hand*
8	147	14	184
9	151	15	191
10	161	16	196
11	169	17	196
12	170	18	197
13	184		

Accurate calibration requires more than average. — If we know the height of a man and know also the average height of other men, we can say roughly whether the man in question is relatively short or relatively tall. If we know that a certain boy taps 196 times in 30 seconds and if we know also the average tapping rate, with the same hand, of boys of his own age, we can say roughly whether the boy in question is a relatively slow or a relatively rapid tapper. But that is about all we can say in these cases. We cannot say without more basis than this whether the man who is taller than average is very much or only slightly taller; we cannot say whether the rapid tapper is very much or only slightly more rapid than the average boy of his age. In order to do more than this we need to know, not only what the average attainment is, but just how widely scattered people are about that average. We happen to know that

a man six feet and four inches tall is very much taller than average. Our knowledge here is not, however, based upon the simple fact that the average height is about five feet and eight inches. A divergence of eight inches from the average height is actually a large divergence, but that is not because eight inches is necessarily a great distance. It is rather because so few people happen to differ this much from the average.

Norms of the more complete variety necessary for accurate interpretations of ability may take the form of the following tables.

Distribution Tables (Thorndike after Courtis)

Distribution of Ability in Copying Figures in 6th-grade Children

Number of digits copied in 60 seconds	*Frequency in 6th-grade children*
0 to 9	9
10 to 19	12
20 to 29	22
30 to 39	18
40 to 49	57
50 to 59	107
60 to 69	291
70 to 79	536
80 to 89	1274
90 to 99	1256
100 to 109	1066
110 to 119	494
120 to 129	359
130 to 139	64
140 to 149	36
150 to 159	19
160 to 169	47
170 to 179	2
180 to 189	1

Distribution of Ability in Adding Pairs of One-place Numbers in High-school Pupils

Number of pairs added in 60 seconds	*Frequency in high-school pupils*
20 to 29	2
30 to 39	4
40 to 49	41
50 to 59	113
60 to 69	272
70 to 79	235
80 to 89	196
90 to 99	86
100 to 109	43
110 to 119	2
120 to 129	2

The first of these tables shows how many sixth-grade children copied between 0 and 9 digits in 60 seconds, how many copied between 10 and 19 digits in 60 seconds, and so

on. While the average number copied has not been calculated, we can tell by mere observation that it lies somewhere between 80 and 109 digits in 60 seconds. Any individual child, therefore, making a score of between 80 and 109 in this test may fairly be judged to be neither fast nor

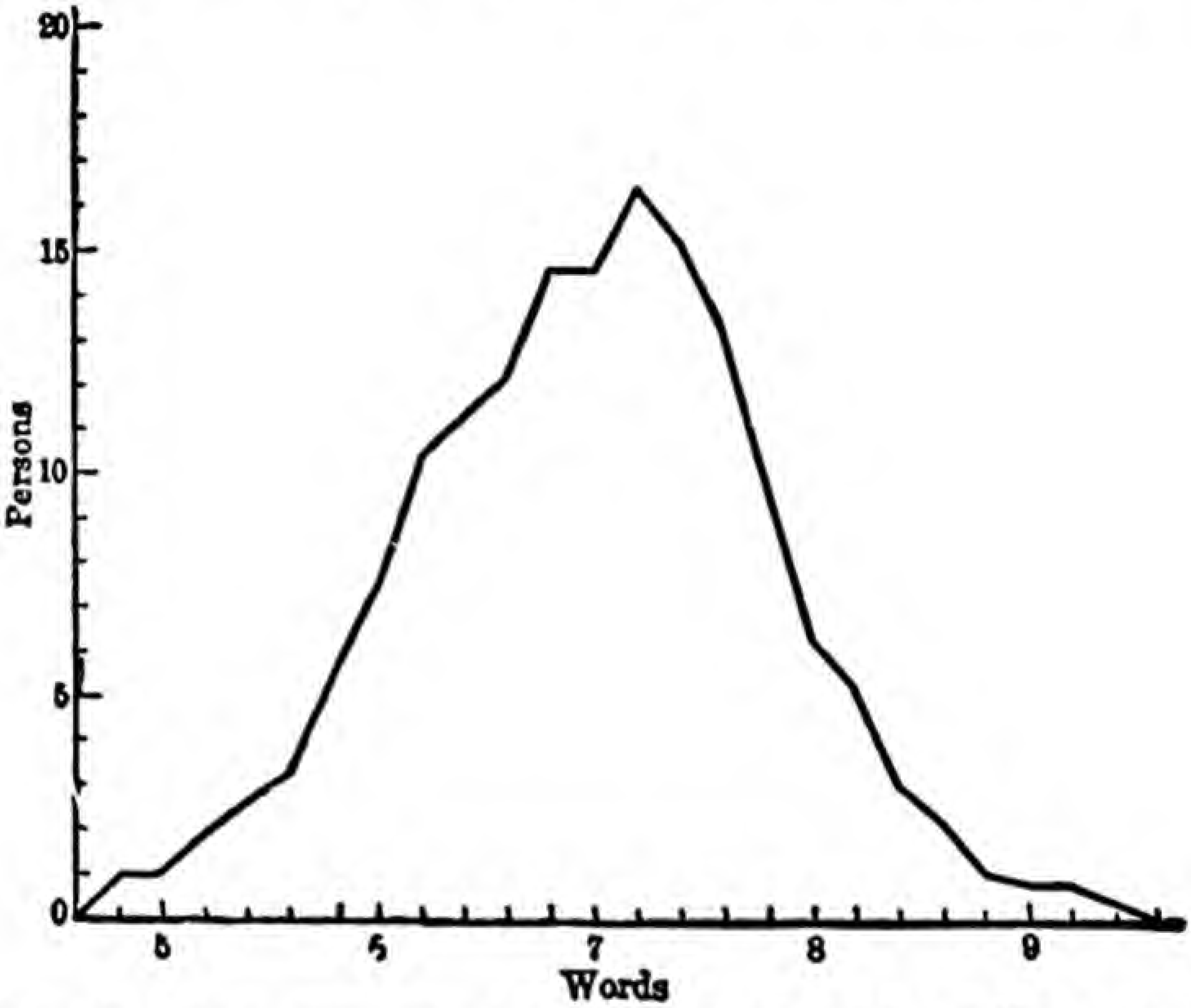


Fig. 46. — Distribution of Memory Ability of 173 University Students

The test consisted in dictating ten monosyllabic nouns. The persons then recorded the number of words that they remembered. The horizontal axis indicates the number of words and the vertical axis indicates the number of persons having each memory ability. (From Starch, *Educational Psychology*, The Macmillan Company.)

slow, but medium, in copying digits. A child who scores 65 is clearly slower than the average, and yet he can hardly be judged extremely slow because there are, after all, a good many children who copy no faster or even more slowly. A child whose score is 125 is clearly faster than the average, and yet he can hardly be judged extremely fast, because there are a good many children who copy as fast or faster. But a

child who scores 6 is certainly to be described as extremely slow and the child who scores 175 is certainly to be described as extremely fast. In the former case we are dealing with one of the nine slowest out of several thousand individuals,

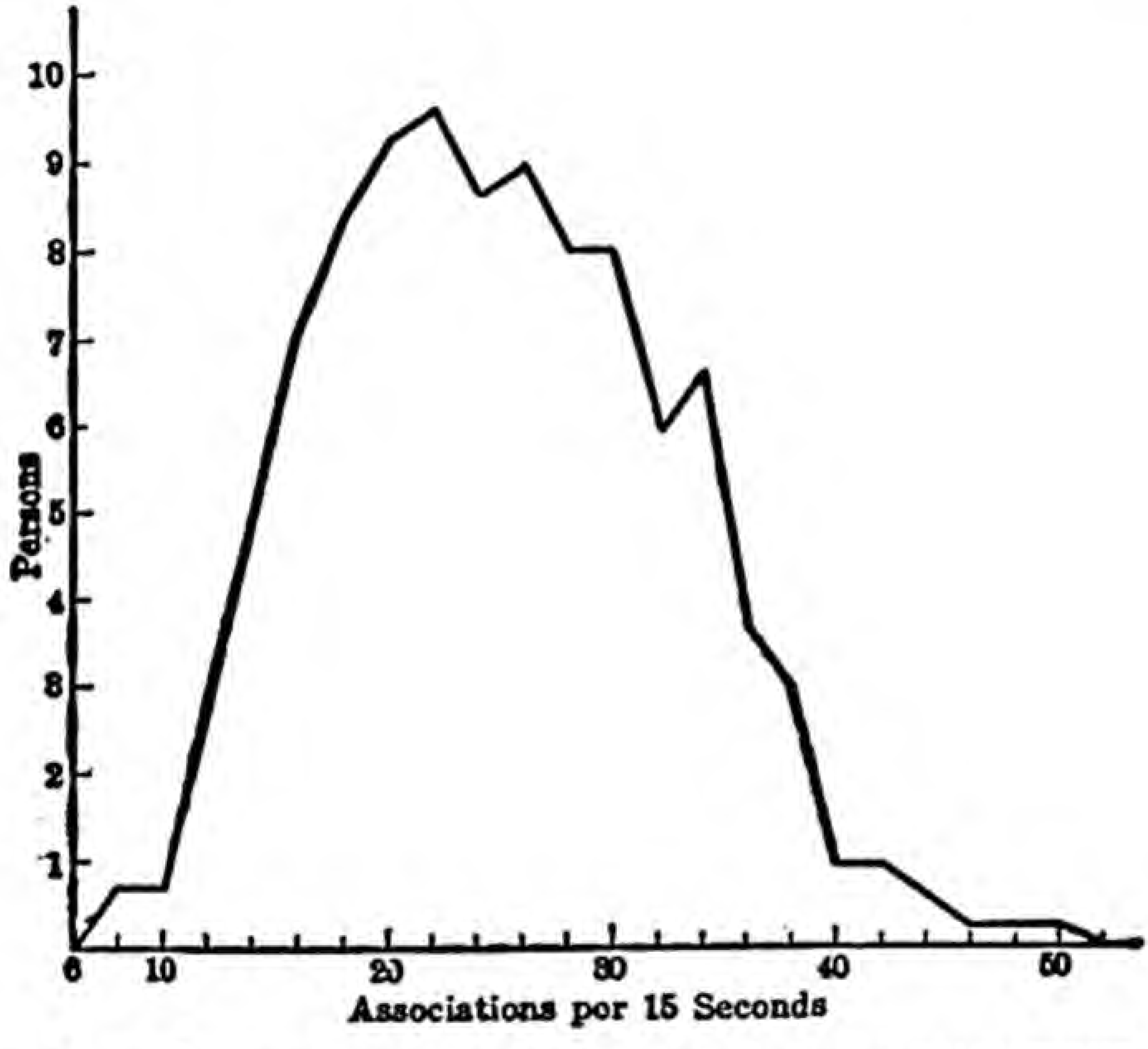


FIG. 47. — DISTRIBUTION OF ABILITY IN GIVING ASSOCIATIONS IN RESPONSE TO A STIMULUS WORD

The horizontal axis represents the number of words given in 15 seconds. The vertical axis represents the number of persons of each ability. Based on the records of 135 persons. (From Starch, *ibid.*)

and in the latter with one of the three fastest out of several thousand.

Data regarding the distribution of ability are often made vivid by being shown in the form of a graphic figure like those above. (Figs. 46 and 47)

Most abilities are distributed in the same general manner. — The distribution of the abilities represented in the fore-

going tables and in the graphs are fairly typical of abilities of all sorts. In the first place, if we consider the various amounts of ability from the highest to the lowest, and if we consider a great many individuals, we usually find that every intermediate degree is represented by somebody. That is to say, there are no great gaps in our tables or our graphs. In the second place, a great many persons are clustered near the average. As we depart from the average we find fewer and fewer persons possessing each degree of ability encountered, until finally we come to degrees of ability so low or so high that they are possessed by no one or by practically no one. In the third place, we

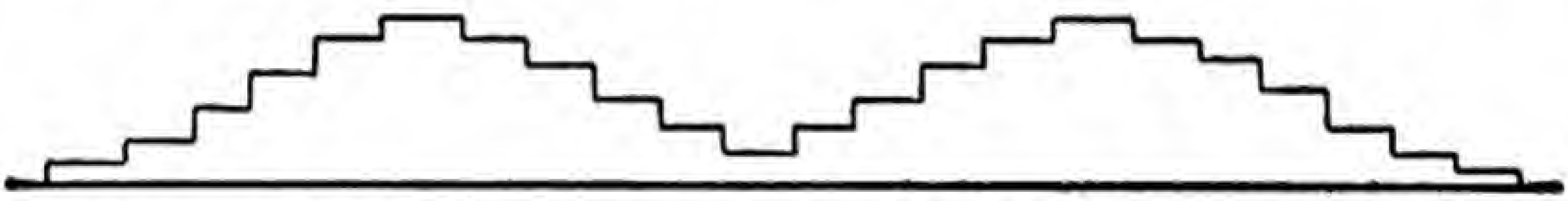


FIG. 48. — GRAPH SHOWING MEASUREMENTS OF A GROUP THAT SHOULD BE CONSIDERED AS TWO GROUPS

The base line represents varying degrees of some ability. The height of the graph at each point shows the number of persons having that degree of ability.

usually find about as many persons of less than average ability as we do persons of more than average ability.

The facts learned from the study of how abilities actually are distributed are of some consequence, because they show us the error in certain common opinions. For example, we sometimes hear it said of a certain ability that a person either has it to a high degree or else does not have it at all. If that were true, we should find people clustering around two regions — around a region high in the scale of measurement and around a region low in the scale of measurement — and we should find a pronounced gap between the two. If such a distribution were represented graphically, it would appear something like Figure 48. Distributions of ability rarely, however, take such form. In fact, they practically never do

unless there is something other than the ability in question which tends to divide the persons whose ability is measured into two distinct groups. If we represented in the same graph the distribution of running ability of 100 ten-year-olds and 100 fifteen-year-olds, we should undoubtedly find our individuals clustering about two points rather than one. But this division would be caused by the difference in ages rather than by the nature of the trait itself. It would by no means show that people tend to be either fast runners or slow runners.

B. Measurement of Simple and Complex Abilities

Abilities may be simple or complex. — As we showed in Chapter III, every individual possesses not only simple habits, but also systems or organizations of such habits. We may now properly call the level of efficiency of a simple habit, such as distinguishing the higher from the lower of two tones, a *simple* ability. The level of efficiency of a complex system of habits, such as tennis playing, we may properly call a *complex ability*.

Simple abilities are easier to measure. — As a general rule, the simpler an ability, the easier is the task of measuring it and the more likely is the measurement to be accurate. One can measure the accuracy with which a baseball player can throw or the speed with which he can run very much more easily than one can measure his efficiency in baseball playing as a whole. One can measure a student's efficiency in giving the French equivalents for a list of English words more easily than one can measure as a whole the same student's ability to use the French language.

This fact that complex abilities are usually harder to measure than simpler ones has much practical importance. While we do, upon occasion, wish to know how well someone

can distinguish between higher and lower tones, how quickly he can run one hundred yards, or how accurately he can translate a certain French sentence, still we are more often concerned with abilities of greater complexity. What we are likely to need in everyday life is knowledge, not of some-one's simpler abilities, but rather of his ability as a pianist, his ability as a football player, or his ability to use French.

We can sometimes analyze complex abilities into simpler abilities. — Since simpler abilities are, as a rule, easier to measure accurately than are those of greater complexity, it is only natural for us to ask ourselves whether it would not be possible to break up a complex ability into a number of abilities of a simpler sort, and then to measure these simpler abilities separately. This procedure has, as a matter of fact, been found practicable in many instances. Consider, for example, the ability to drive an automobile. On the face of it, any attempt to measure this complex ability as a single whole would be extremely difficult. A practice which has sometimes been adopted is that of analyzing automobile driving into such simpler abilities as steering, shifting gears, starting, stopping, backing, and braking. Upon the basis of one's performance in these simpler tasks a judgment is made of one's efficiency in the complex business of driving a car. In a similar way the young doctor's ability in medicine is determined by dividing this great field of knowledge into a number of simpler parts, such as anatomy and physiology, and then measuring his mastery of those parts.

But this determination of the level of a complex ability through the measurement of its parts is by no means an infallible procedure. Even when we are able to detect all the simple abilities composing a complex ability (and this is a very difficult matter), we are faced with the question as

to just how, in the complex ability, the simpler ones are organized. It is certainly evident that braking, gear shifting, steering, and the rest are not all of equal importance in automobile driving. Although all of them are important, a high degree of ability in steering should probably receive more weight than a high degree of ability in shifting gears. But how much more weight? The difficulty of answering that question in any exact terms is clear.

There is another prevalent source of error in the analytic measurement of complex abilities. Often the important fact about one of these complex abilities is how well the simpler acts which compose it operate in combination. A difficult situation might easily arise in which a driver, who could ordinarily steer accurately and shift gears easily, would perform wretchedly when faced with the necessity of doing both well at once. Now, just this type of circumstance is likely to be overlooked when we judge a complex ability on the basis of the simpler abilities of which it consists.

C. Measurement of General Abilities

General abilities also may be measured. — There is often a need for measuring such general abilities as manual dexterity or intelligence. The problem which such a need presents is in many ways more difficult than the measurement of complex abilities of the type we have just been discussing. Manual dexterity in general involves all of the manifestations of such dexterity of which the individual is capable. It may mean his dexterity with a hundred different kinds of tools, his dexterity in all the games of skill that he knows, his dexterity with foodstuffs or chemicals, his dexterity in driving a car, and so on. Obviously the measurement of even the greater part of these would be impossible. The actual procedure in measuring a general ability like

dexterity is usually this: From among all of the simpler manual abilities of the individual a few are selected which seem to be fairly representative of the rest. These are measured, and upon this basis a conclusion is reached as to the general ability.

The measurement of dexterity. — In the case of a general ability, like dexterity, it may not be feasible to measure its usual manifestations. One reason for this state of affairs is that even such relatively simple manipulations as tying a shoe or eating salad may be extremely difficult, if not impossible, to measure. As a result, special tests are sometimes devised for the measurement of various aspects of dexterity. The speed with which one can move the hand may be measured by having a person push downward on a telegraph key at a given signal. Such reactions normally take in the neighborhood of only one-tenth of a second, so that delicate apparatus is required. Such apparatus is to be found, however, in many psychological laboratories. Another test for speed of movement is the one that requires the subject to strike a metal plate with a metal pointer as often as possible within a stated interval of time (see Fig. 45). The number of contacts of pointer on plate is registered by means of an electric counter. There are many other tests of dexterity. In one the subject holds a metal pointer in a small hole in a metal plate as long as possible without letting

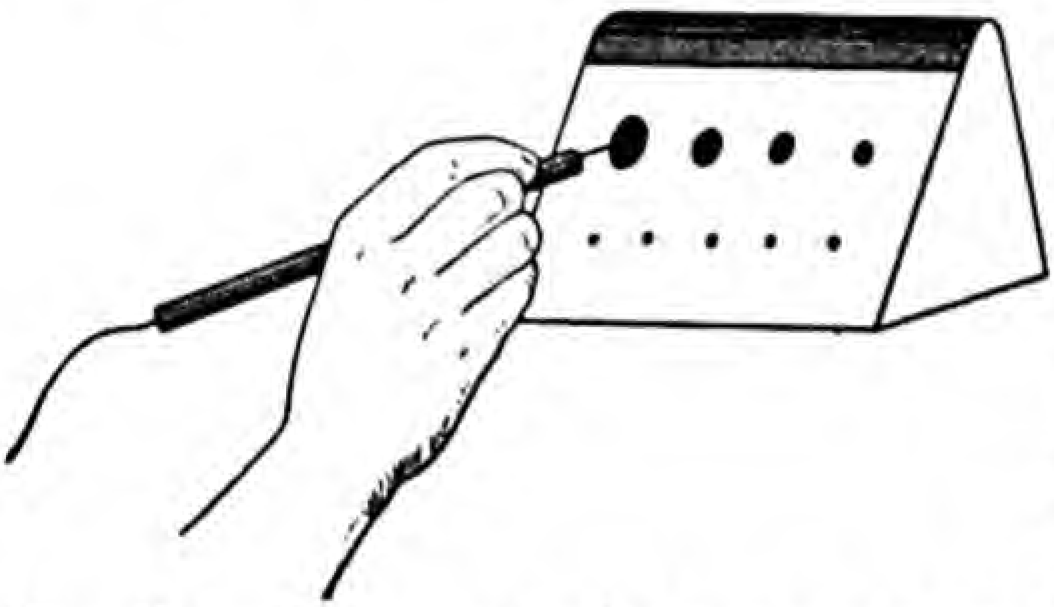


FIG. 49. — A TEST FOR STEADINESS OF THE HAND

Every time the stylus touches the edge of the hole there is an electrical registration.

it touch the edge of the hole. In another he thrusts with a pencil at a paper target.

The measurement of general intelligence. — In modern life it is perhaps even more necessary to measure general intellectual ability than it is to measure general dexterity. Many tests have been devised by psychologists for this purpose. The method employed is essentially that which we have already described. A number of sample intellectual abilities thought to be fairly representative are selected and measurements are made of these.

Alfred Binet, about the beginning of the present century, devised one of the first tests of general intelligence. His test was really a series of tests applicable to children of different ages. A revision of the Binet tests made by Professor Terman of Stanford University is widely used in American schools. The following summaries of the tests for three-year-olds and for ten-year-olds give an excellent idea of the wide variety of intellectual abilities measured for the purpose of determining intellectual ability in general.[1]

Age 3

Points to the nose, eyes, mouth, hair. To pass the test, the child must succeed in 3 of the 4 tasks.

Names familiar objects — key, penny, closed knife, watch, pencil. Subject must succeed in 3 of the 5 tests.

Enumerates at least 3 objects seen in 1 of 3 pictures displayed separately.

Gives sex, *i.e.*, boy or girl.

Tells last name.

Repeats sentence containing 6 or 7 syllables; *e.g.*, "The dog runs after the cat."

Repeats 3 digits, one success in 3 trials.

Age 10

Defines satisfactorily at least 30 words of a list of 50, ranged in order from easy to difficult. Words at about the 10-year level of difficulty

[1] Summary taken from Gates, *Psychology for Students of Education*, p. 423 (The Macmillan Company).

are: bewail, priceless, disproportionate, tolerate, artless, depredation, lotus, frustrate. The hardest words in the list which are mainly too difficult for the average adult are: piscatorial, sudorific, parterre, shagreen, and complot.

Detects the "absurdity" in 4 out of 5 statements such as the following: "A man said: 'I know a road from my house to the city which is down hill all the way to the city and down hill all the way back home."

Copies from memory a geometrical figure previously studied for 10 seconds.

Gives satisfactory answers to 2 out of 3 questions such as the following: "What ought you to say when someone asks your opinion about a person you don't know very well?"

Must be able to say spontaneously at least 60 words — any words of which the subject can think — in a period of 3 minutes.

There are also tests of general intelligence designed primarily for adults. One of the best known of these is the Army Alpha examination which was devised for measuring the general intelligence of soldiers. Like all other tests of general intelligence, this one requires the examinee to perform a variety of tasks. There are directions to follow such as these: Make a cross in the space which is in the triangle but not in the square, and also make a figure 1 in the space which is in the triangle and in the square. (Not over 10 seconds allowed.)

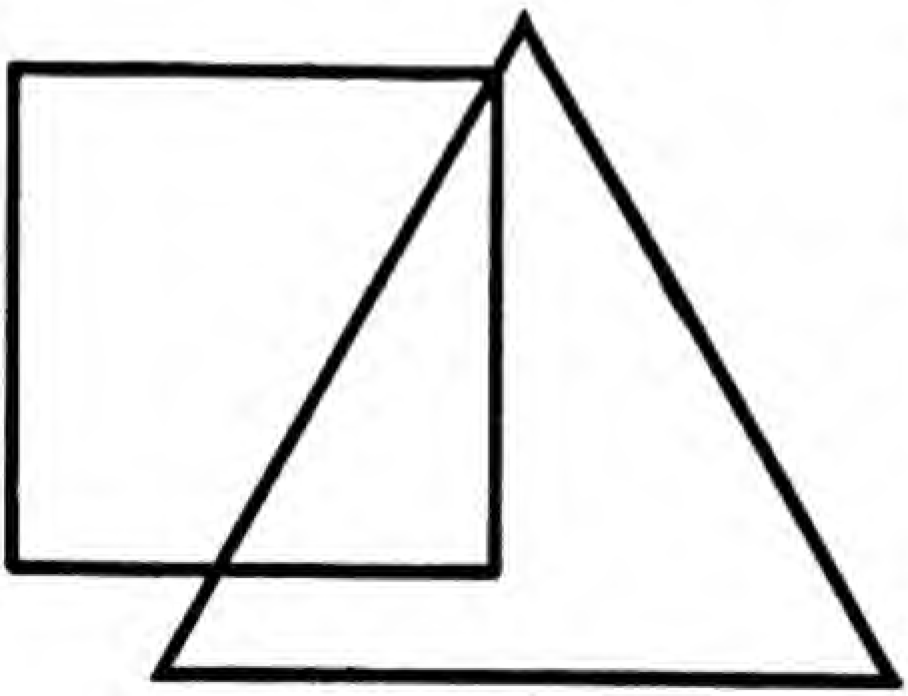


Fig. 50.

Square and triangle for Army Alpha examination. (See text.)

There are 20 arithmetic problems to be solved. One part of the test requires the subject to select out of several possibilities the best reason why some fact is true. For example,

the statement appears that cats are useful animals. The examinee must determine whether this is because:

they catch mice
they are gentle
they are afraid of dogs

In another place the examinee is required to complete a number series like

	10	15	20	25	30	35	—	—
or	3	6	9	12	15	18	—	—

These examples are sufficient to show the variety of tasks incorporated in this test of general intelligence.

General ability tests employ the method of sampling. — The method of measurement employed in the case of general abilities has parallels in other fields of measurement. If a man wishes to know the general quality of a carload of ore which he is purchasing, he does not have every piece in the car examined. That would usually not be feasible. Instead, therefore, he selects a number of pieces from various parts of the car and judges the carload in terms of these samples. Similarly in the measurement of general ability, the level of the general trait is based upon the samples.

Why are general abilities important? — In the affairs of everyday life it is not general dexterity nor general intelligence with which we have our practical dealings. The dexterity with which we are concerned is dexterity in this, that, and the other specific task. And the same is true for intelligence. Why then, one might ask, is it important to take measurements of general abilities? Perhaps the main reason runs something like this: Often we want to know how well a person is likely to acquire some complex habit or set of habits which he does not yet possess or which he now possesses to only a very limited degree. For example, we often want to know what chances a freshman has of

profiting from a college course. We cannot wait until the end of his training to find out. Neither can we measure his ability in subjects which he has not yet studied. But we can measure his ability in intellectual realms where he has had experience. We can, for example, take into account the grades he made in high school. Consider the situation which confronted army officials as thousands of recruits poured into the cantonments following our entrance into the Great War. The officers wanted to know how able these men were to learn the science of warfare. Most of them had had no experience with military affairs, however, and clearly a test of their military ability would be of little significance. So, by means of the Army Alpha examination, measurements were taken of intellectual abilities which most of the recruits had had ample opportunities to acquire. In this way fairly reliable results could be obtained in regard to what level of intellectual attainment might be expected of these men in the future. Of men rating above C+ in this examination only 8.65 per cent failed to make good when put into an officers' training school. Of men rating below C+, 58.27 per cent failed to make good.

The measurement of general musical ability. — One of the most interesting attempts to measure a general ability is that which has been made by Professor Seashore of the University of Iowa in the field of music. Every child, from the early years of his life, has experience with tones of different pitches, intensities, and timbres. He also comes into contact with harmonies, melodies, and rhythms. These experiences are often casual, but, nevertheless, some children learn a great deal from them. Others, of course, learn much less and still others learn scarcely anything at all. But here is the important point! The capacity of a person to profit by a formal musical education — piano lessons, let us say —

can be predicted quite accurately from the musical abilities which he has acquired as a result of the informal musical experiences which almost everyone has.

By means of laboratory methods, which there is no need

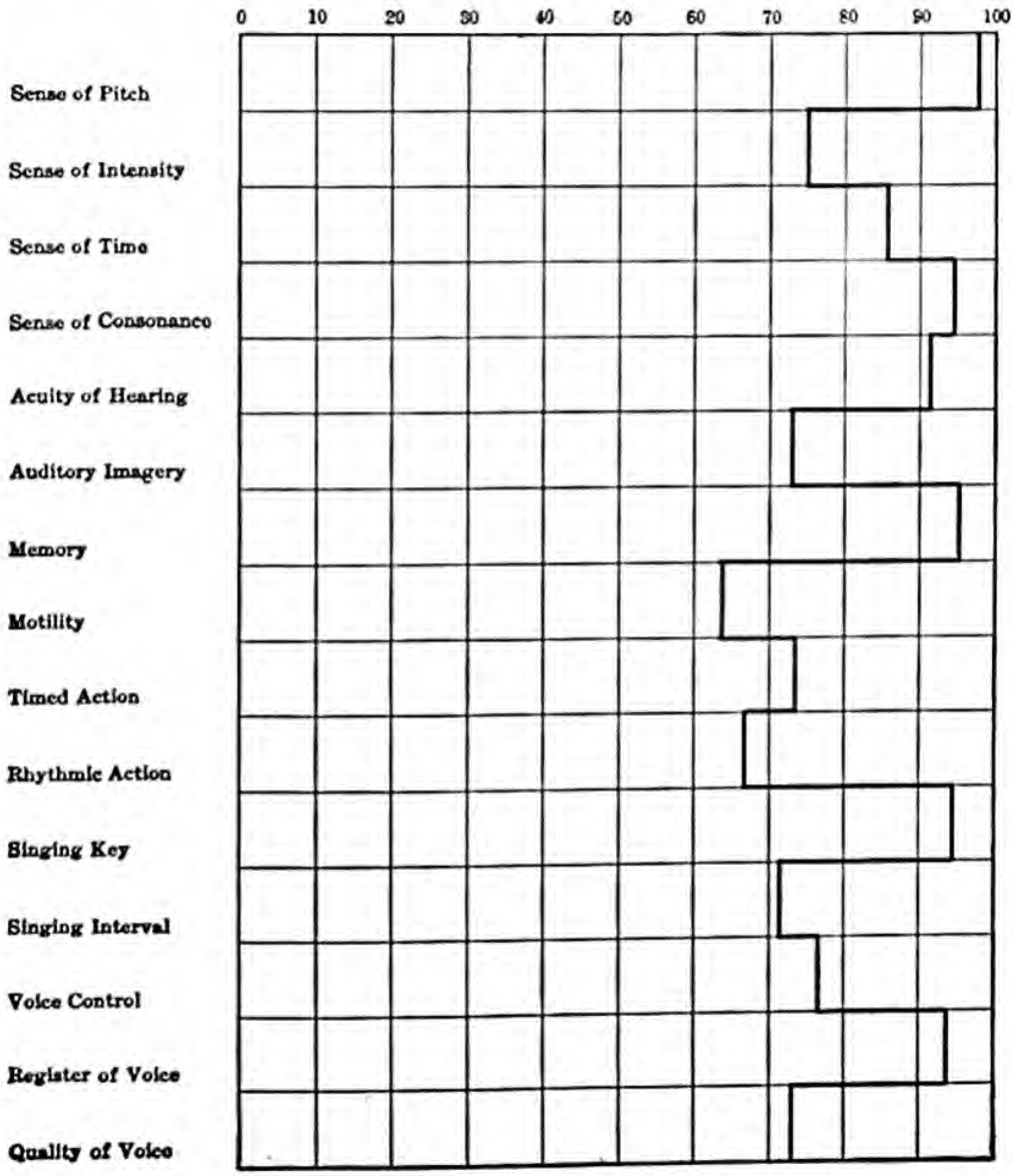


FIG. 51. — TALENT CHART OF MR. WHITE

The scale at the top shows whether a large or a small amount of the talent is possessed, 1 being the lowest unit and 100 the highest. (From Seashore, *Psychology of Musical Talent*, by permission of Silver, Burdett and Company.)

for us to describe here, it is possible to measure those musical abilities upon which later development along this line will depend. The results of such measurements are ordinarily put into the form of such charts as those shown by Figures 51, 52, and 53.

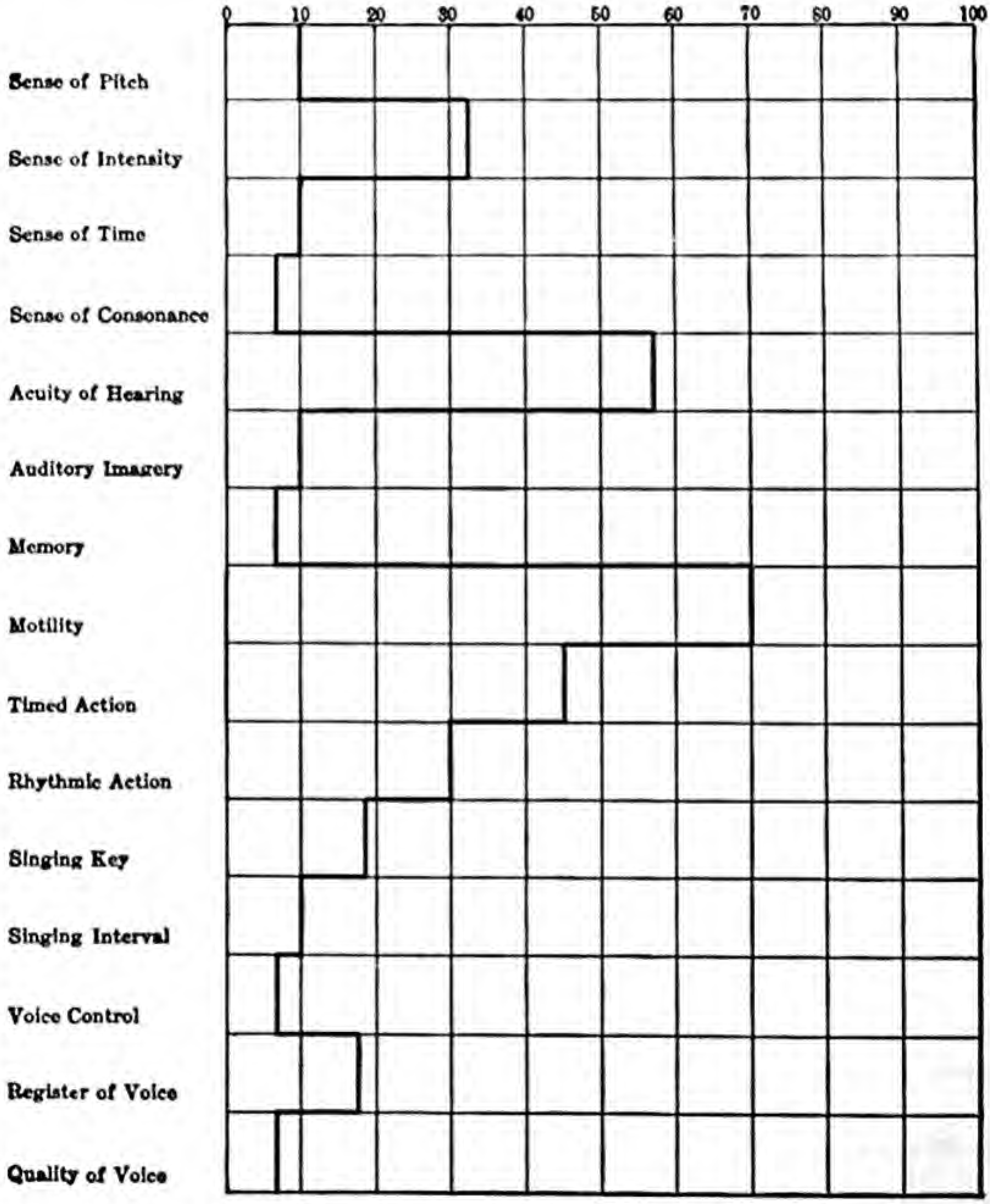


FIG. 52. — TALENT CHART OF MR. BLACK

The explanation of Figure 51 applies to this chart also. (From Seashore, *Psychology of Musical Talent*, by permission of Silver, Burdett and Company.)

Mr. White scored high in practically all of the simpler musical abilities in respect to which he was measured.

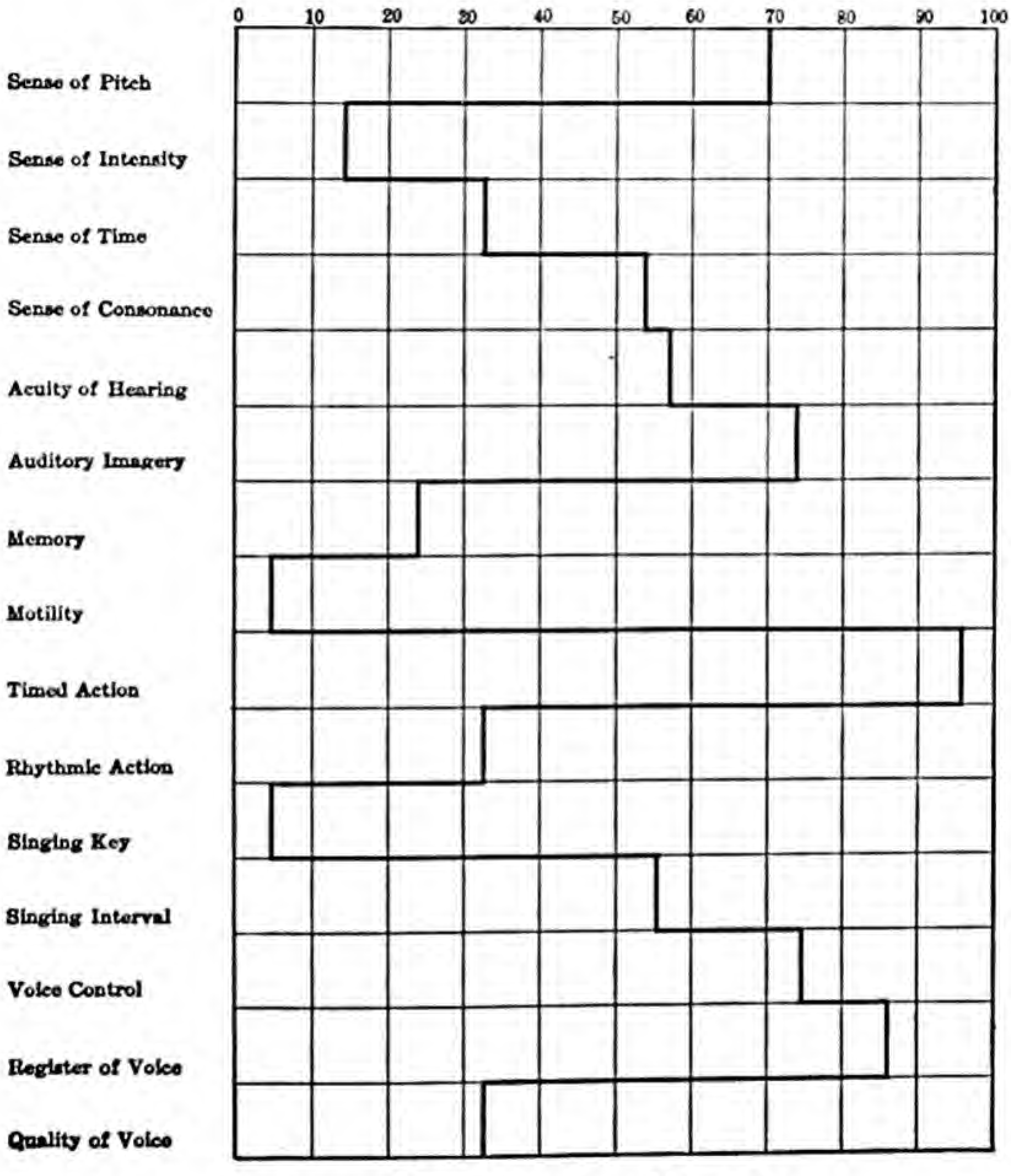


FIG. 53. — TALENT CHART OF MR. GRAY

The explanation of Figure 51 applies to this chart also. (From Seashore, *Psychology of Musical Talent*, by permission of Silver, Burdett and Company.)

Mr. Black, on the other hand, scored low in practically all of the simple musical abilities in respect to which he was

measured. We may confidently say then that Mr. White is a man of good general musical ability, and we may feel fairly certain that he would profit from almost any sort of formal musical training. But Mr. Black possesses inferior general musical ability, and formal musical training in his case would probably be a waste of time and money. Mr. Gray's chart is more difficult to interpret. Some of his simpler musical abilities are good, some are poor, and some are medium. One might say, on these grounds, that his general musical ability is about average. There is a possibility, however, that he might develop considerable musical ability in some particular field of music where too great demands would not be made upon his weaker points.

Measurement of general abilities has certain definite sources of error. — In the measurement and interpretation of such general abilities as dexterity, intelligence, general musical ability, and the like, there are possibilities for making mistakes and these possibilities should be squarely faced. In the first place we may err by measuring too few of the abilities which are represented by the general ability in question. Such errors are frequently made in the measurement of general intelligence. Intellect may be shown in dealing with people, in dealing with physical objects, or in dealing with words and numbers. Nevertheless the majority of tests which pretend to measure general intelligence (and this is certainly true of the Army Alpha examination of which we have spoken) take account almost solely of the subject's intelligence with words and numbers. As long as such tests are used for predicting how well one can get along with work which is largely a matter of words and numbers, no practical harm is done, but when judgments are made upon such a basis as to how well a

person will be able to deal with people or with machinery there may be serious mistakes.

If the individuals whose general ability is measured have had very unequal opportunities to acquire those particular abilities which are taken as representative of this general type of activity, then it is difficult to apply our measurements accurately. A high score in a test of general intelligence may mean that the person making this score picks up intellectual habits easily or that he has so far had unusually good opportunities for picking up such habits. In practice we try to avoid this source of error by selecting as samples of a general ability the abilities which the individuals whom we are going to measure have had practically equal opportunities to acquire.

Another important source of error occurs in the application of these measurements of general abilities. The virtue of measurements of dexterity in general is that they give us grounds upon which to predict how well a person will get along in any work or play requiring dexterity. The wider the variety of dexterities which we measure in determining general dexterity, the wider the variety of still unacquired dexterities that we can make predictions about. It is right here that there lies a source of error. A general ability may be so general that it gives some ground for predicting future abilities of almost any kind, but this very generality means that our predictions are likely to possess a low degree of accuracy. Let us suppose that we had measured a man's efficiency in 300 intellectual tasks and that 100 of them had dealt largely with words and numbers, 100 with people, and 100 with physical objects. As a result we have some notion of his general intelligence which enables us to say something about how well he will get along in any situation requiring intelligent action. But our prediction of how well he will get

on with words and numbers will be more accurate if we base that prediction, not upon his intelligence so far as it embraces all of his manifestations of intelligence, but rather so far as it embraces only his manifestations of intelligence in dealing with words and numbers. In other words, it is usually true that the more abilities are included in some general ability, the more widely, but the less accurately, we can apply our knowledge of that general ability.

It is difficult to measure abilities under natural conditions. — We have said that one reason for the invention of laboratory tests for different types of dexterity is the difficulty of measuring the precise abilities which are operative in actual, everyday life. We spoke of how difficult it would be to measure the efficiency of tying a shoe or eating salad. The difficulty of measuring abilities just as they appear in actual life is a source of error in all varieties of measurements of ability. Even when, for test purposes, it is possible to measure the ability to steer, the ability to shift gears, or some other ability of indisputable importance for practical life, it is usually impossible to test them under natural conditions. Sometimes the conditions under which the test is performed make a person very much more anxious to do well than he normally is. The test conditions may also be of such a nature as to disturb his usual calm self-confidence.

D. Testing the Value of Measurements

Value of measurements of ability depends upon how well they work in practice. — Whenever sources of error are pointed out in any procedure, there are always some people who want to throw over the procedure in disgust. Since it is not possible for human beings to have perfect methods for measuring ability, or for any other purpose so far as that goes,

such an attitude is absurd. Although our present methods of measuring abilities give us only approximations, still approximations are better than mere guesses. And we shall be led to increase the accuracy of our present approximations, not by neglecting sources of error, but by facing and acknowledging them.

We have considered a few of the outstanding sources of error in measurements of ability. Knowing what these are, we are enabled to go about the business of measurement more wisely. Nevertheless, the real determination of the accuracy of our measurements must depend upon how well they work in practice. The accuracy of our measurements of skill in automobile driving can get its final and most reliable check only in terms of how well these measurements agree with the abilities which men show after they have actually been on the job driving a car. We have said that high-school grades are used as measurements of general scholarly ability and that, upon this basis, predictions are made as to how well freshmen will get along with college studies. The final test of how well such a procedure operates must come from a study of how well college students with good high-school grades get along as compared with students with poorer high-school grades. When he who does well in tests of automobile driving also proves to be a good driver under the conditions of real life, we say that there is a *positive correlation* between ability as tested and ability as manifested on the actual job. Similarly, we say that there is a positive correlation between high-school grades and scholarly achievement in college if those who make the highest grades in high school also make the highest grades in college. The practical success of measurements of ability, then, depends upon whether they have a good correlation with some later manifestation of ability which it is desirable for us to predict.

Comparison of Mental Alertness Test Scores of Nineteen Office Employees with Ability Ratings[1]

Employee	*Ranking by test*	*Ranking in ability by two supervisors*
A	1	2
B	2	3.5
C	3	5
D	4	6
E	5	7
F	6	1
G	7.5	14
H	7.5	9
I	9	3.5
J	10	12
K	11	15
L	12	18
M	13	8
N	14	16.5
O	15	10
P	16	13
Q	17	11
R	18	16.5
S	19	19

In the above table we can see how well a test designed to measure general alertness correlates with actual success in an office job. Nineteen employees were tested and ranked according to their performance in the test. The person making the highest score was given a rank of 1, and the person making the lowest score was given a rank of 19. The others were arranged between according to their scores. The reason why two of the employees were given ranks of 7.5 is that they both made the same score. In the right-hand column of the table are the ranks of the same employees as decided by supervisors who knew their performance, not in the test, but on the job. The correspondence between the two sets of ranks is, in this case, fairly good. While only one employee has the same rank according to test and

[1] Adapted from Kornhauser and Kingsbury.

supervisors, still the individuals having high ranks in one column have, in most cases, high ranks in the other column, and the same is true for those with low ranks. Such a test is decidedly useful. Its measurements are not perfectly accurate in their application, but they give us a basis for predicting later success, which is very much better than no basis at all.

The correspondence between test ratings and later performance can also be studied by means of such a chart as

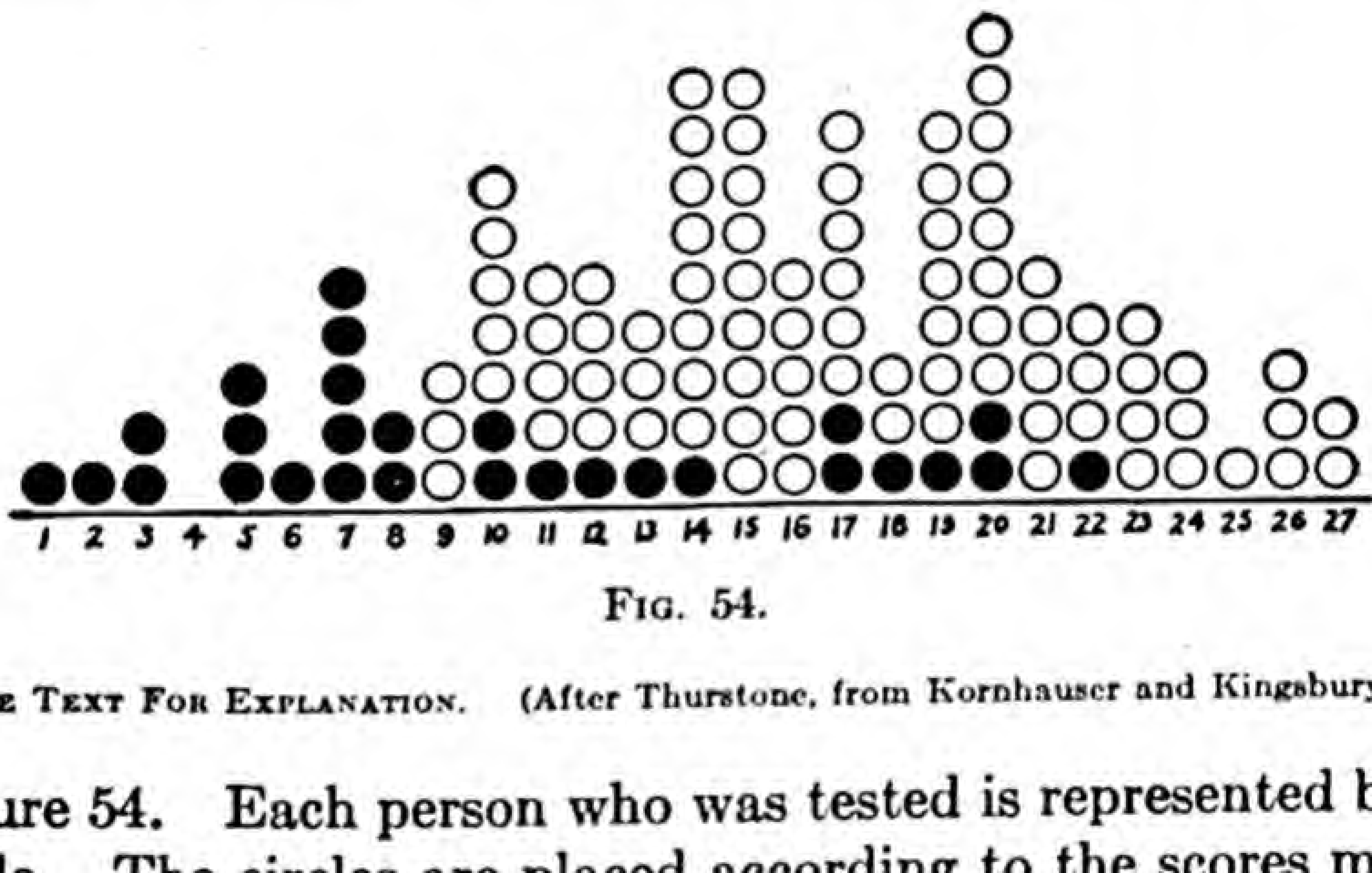


FIG. 54.

SEE TEXT FOR EXPLANATION. (After Thurstone, from Kornhauser and Kingsbury.)

Figure 54. Each person who was tested is represented by a circle. The circles are placed according to the scores made by different subjects in the test. Thus there are two circles at 27, which means that two persons made that score in the test, three circles at 26, and so on. The individuals whose records are shown here were students. Those who failed to make good in their class work are shown by solid black circles. The others are shown by unshaded circles. Now a glance at this chart shows that there is a positive correlation, or correspondence, between the test records and scholarship. Of the 15 individuals with a test score of below 9, not a single one made good in class work, while of those making higher

scores 85 out of 98 (87 per cent) did satisfactorily in their class work. By means of such a test of general ability it would not be possible, perhaps, to keep all of the future failures from attempting college work, but certainly it would be possible to eliminate many for whom such study would be largely a waste of time.

Summary of the Chapter

1. For an adequate understanding of an individual we must know, not only what habits he possesses and how they are organized, but also the levels of efficiency at which these habits operate.

2. Human abilities, like physical traits, can be measured. That is to say, they can be described in terms of quantity.

3. The measurement of an ability in one person can be rendered meaningful only by interpreting that measurement in terms of the amount of the same ability possessed by other persons.

4. When we attempt to classify persons according to the amounts of some ability which they possess, we find that they cannot be grouped, as is sometimes assumed, into two distinct classes: those having much of the ability in question and those having little of it. The majority of individuals are usually found to possess a medium degree of the ability, and fewer are found to possess very high or very low degrees.

5. The abilities easiest to measure are those which represent the efficiency of simple habits, but the abilities with which we are most concerned in actual life are those of greater complexity.

6. We can sometimes measure a complex ability by analyzing it into simpler abilities and then measuring those. The difficulty of this procedure lies in the facts that the analysis itself may be difficult, that we cannot always decide

which of the simpler abilities play the most important parts in the complex ability, and that the complex ability depends as much upon how our simple habits are organized as it does upon the efficiency of those simple habits in isolation.

7. General abilities, such as intelligence, dexterity, and general musical ability, can also be measured. What we are seeking here is a determination of the average level of a number of related abilities. From this we may make predictions as to how well another similar, but still unacquired, ability will be picked up. Here again there are errors to be avoided, but the final test of measurements of general ability must be found by putting those measurements to actual use.

PROBLEMS

1. A certain clerical position requires the ability to read, the ability to write, and the ability to perform simple multiplications. In selecting a person to fill this position what would we want to know about him besides the fact that he possesses these abilities? What important information about a baseball player is still to be acquired after we know that he can bat, catch, throw, and run?

2. Write down a list of those traits and abilities in respect to which you have, at some time or other, been measured.

3. A boy, sixteen years of age, was asked to write as many words as he could think of in three minutes. (The words were not to be in sentences.) He wrote 33 words. What information would you have to have in order to say whether his performance was unusually good, a little better than average, average, a little worse than average, or unusually poor?

4. Suppose that you wanted to show the distribution of ability in the standing broad jump among the members of your class. Would you construct separate graphs for boys and girls? Explain.

5. Enumerate some relatively simple abilities, some relatively complex abilities, and some relatively general abilities other than those mentioned in the text.

6. Enumerate some abilities which would be fairly easy to measure and some which would be more difficult. Show *why* the latter would be difficult to measure.

7. Let the teacher give to the whole class any one of the well-known general intelligence tests applicable to groups.[1] Show by graph and table the distribution of scores for the class. How do the scores made by different members of the class correspond with their grades in psychology? Show this by means of a table similar to that on p. 470.

REFERENCES FOR FURTHER STUDY

Kornhauser and Kingsbury, *Psychological Tests in Business*, pp. 9–12; or *Readings in General Psychology*, Ch. XXI, Selection 2, p. 598 ff.

Kornhauser and Kingsbury, *Psychological Tests in Business*, pp. 17–42; or *Readings*, Ch. XXI, Selection 4, p. 607 ff.

SOME USEFUL BOOKS ON PSYCHOLOGY WHICH ARE NOT TOO DIFFICULT FOR THE BEGINNER

General

Angell, *Chapters from Modern Psychology.* Longmans, Green and Company, 1913.

Drever, *The Psychology of Everyday Life.* Methuen, 1921.

Griffith, *General Introduction to Psychology.* The Macmillan Company, 1923.

Humphrey, *The Story of Man's Mind.* Small, Maynard and Company, 1923.

James, *Psychology, Briefer Course.* Henry Holt and Company, 1923.

James, *Talks to Teachers on Psychology: and to Students on Some of Life's Ideals.* Henry Holt and Company, 1906.

Seashore, *Psychology in Daily Life.* D. Appleton and Company, 1923.

Swift, *Mind in the Making.* Charles Scribner's Sons, 1909.

Swift, *Psychology and the Day's Work.* Charles Scribner's Sons, 1918.

Learning and Memory

Freeman, *How Children Learn.* Houghton Mifflin Company, 1917.

Kitson, *How to Use Your Mind.* J. B. Lippincott Company, 1916.

Pear, *Skill in Work and Play.* E. P. Dutton and Company, 1924.

Watt, *The Economy and Training of Memory.* Longmans, Green and Company, 1909.

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[1] Copies of these can be secured through the C. H. Stoelting Company or through the World Book Company.

Reasoning

Binet, *The Psychology of Reasoning*. Open Court Publishing Company, 1912.

Dewey, *How We Think*. D. C. Heath and Company, 1910.

Aesthetics

Valentine, *An Introduction to the Experimental Psychology of Beauty*. The Dodge Publishing Company, 1913.

Social Psychology

Bogardus, *Essentials of Social Psychology*. University of Southern California Press, 1920.

Gault, *Social Psychology*. Henry Holt and Company, 1923.

Ross, *Social Psychology*. The Macmillan Company, 1916.

Abnormal Psychology

Carrol, *The Mastery of Nervousness*. The Macmillan Company, 1917.

Coriat, *Abnormal Psychology*. William Rider and Son, 1910.

Hart, *The Psychology of Insanity*. G. P. Putnam's Sons, 1912.

Ribot, *Diseases of Memory*. D. Appleton and Company, 1893.

Tests and Measurement

Pintner, *Intelligence Testing*. Henry Holt and Company, 1923.

Experimental Psychology

Myers, *An Introduction to Experimental Psychology*. G. P. Putnam's Sons, 1911.

Applications of Psychology

Griffitts, *Fundamentals of Vocational Psychology*. The Macmillan Company, 1924.

Hollingworth, *Vocational Psychology*. D. Appleton and Company, 1916.

Hollingworth and Poffenberger, *Applied Psychology*. D. Appleton and Company, 1917.

Kitson, *The Mind of the Buyer*. The Macmillan Company, 1921.

Münsterberg, *Psychology and Industrial Efficiency*. Houghton Mifflin Company, 1913.

Münsterberg, *On the Witness Stand*. Doubleday, Page and Company, 1915.

Scott, *Increasing Human Efficiency in Business*. The Macmillan Company, 1923.

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